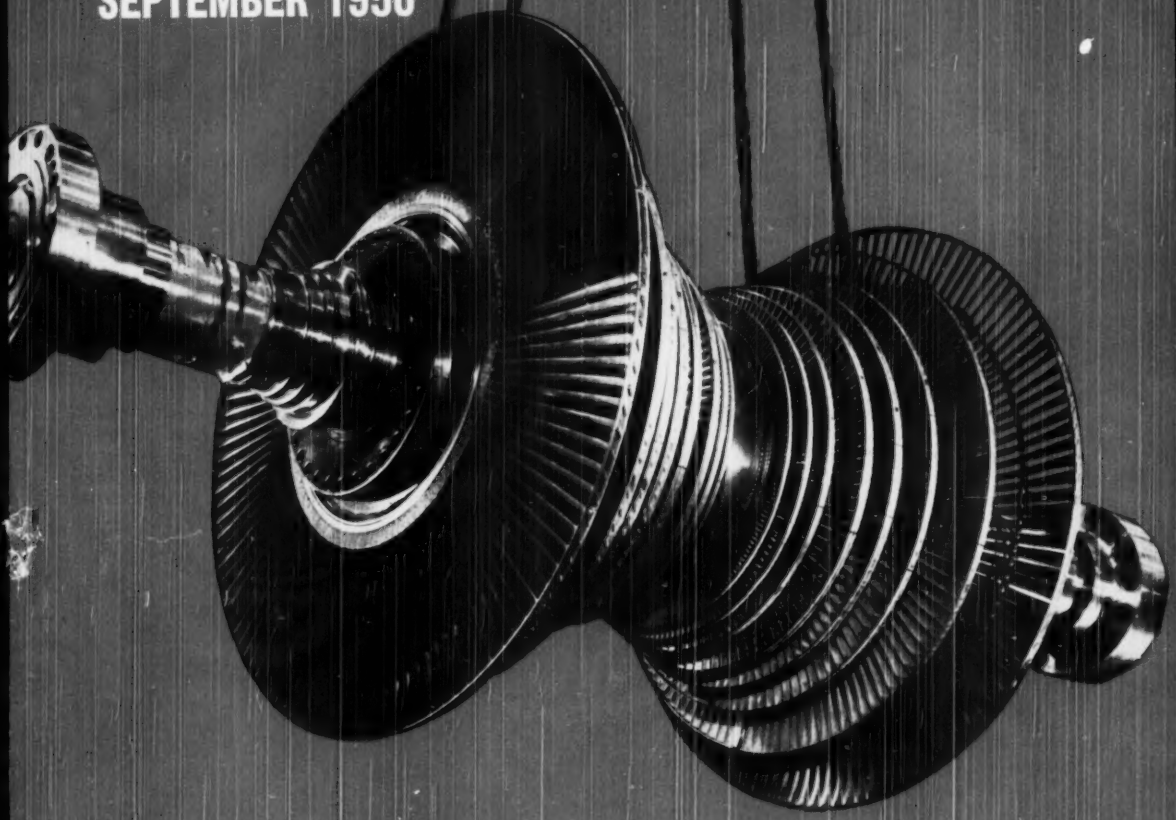
POWER

SEPTEMBER 1950



- BURNING HOG FUEL
- MASTER ANTENNAS FOR TV
- SIZING REFRIGERANT PIPING
- DIESEL CONTROLS AND INSTRUMENTS

Look at both ends of your combustion control

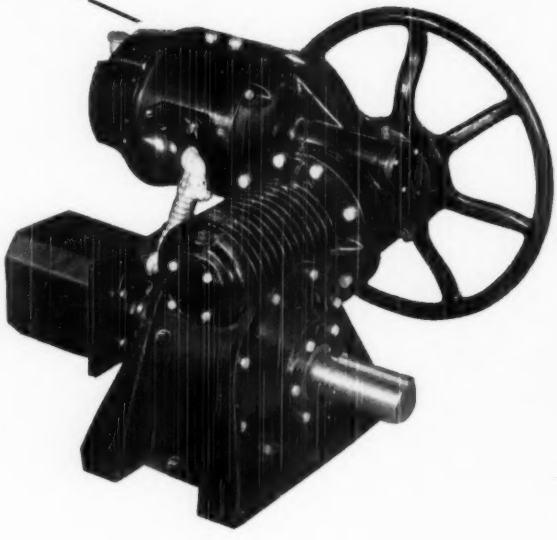
Electric drive units add to Metermax performance

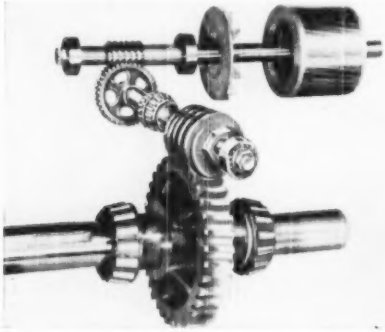
When you're thinking about combustion control, it pays to consider the parts of the system which do the "muscle work" of moving dampers, valves and vanes. In Metermax control, this is done by electric drive units, whose operating features contribute greatly to Metermax performance.

Easy Manual Setting. Ordinarily nothing interferes with the operation of these units except failure of the plant power supply. In emergencies, each controlled element can be moved manually by means of its handwheel. There's no need to disconnect linkages. Gear reduction enables operator to move even heavy dampers easily, quickly.

No Clogging. Because they're operated by electrical power, drive units are immune to clogging and freezing of power lines. Units can be mounted outdoors without any special precautions. Operation is just as reliable as the plant's power supply.

Simple Installation. Complete linkage is provided with each unit. Mounting feet are integral with the drive mechanism—easily bolted to a steel or concrete base.





Self Locking. Output shaft is driven through a double worm and gear reducer which can't be backdriven. When power shuts off, dampers stay in their existing position. No remote locking or reset devices are needed. The drive is always ready to resume control action without any attention by the operator for unlocking or resetting.

Accurate Position Indication. Remote indicators on the Metermax panel show true position of controlled elements. Friction load or sticking of dampers cannot cause false position measurement.

Simple Remote Control. Each controlled element can be independently taken off automatic and regulated by manual remote control, just by turning its individual switch. Electric control makes transfer instantaneous . . . no "reset" position, no waiting.

For complete details about Metermax, write to Leeds & Northrup Company, 4910 Stenton Avenue, Philadelphia 44, Pa.

Ind. Ad. NU9-01-463(3)

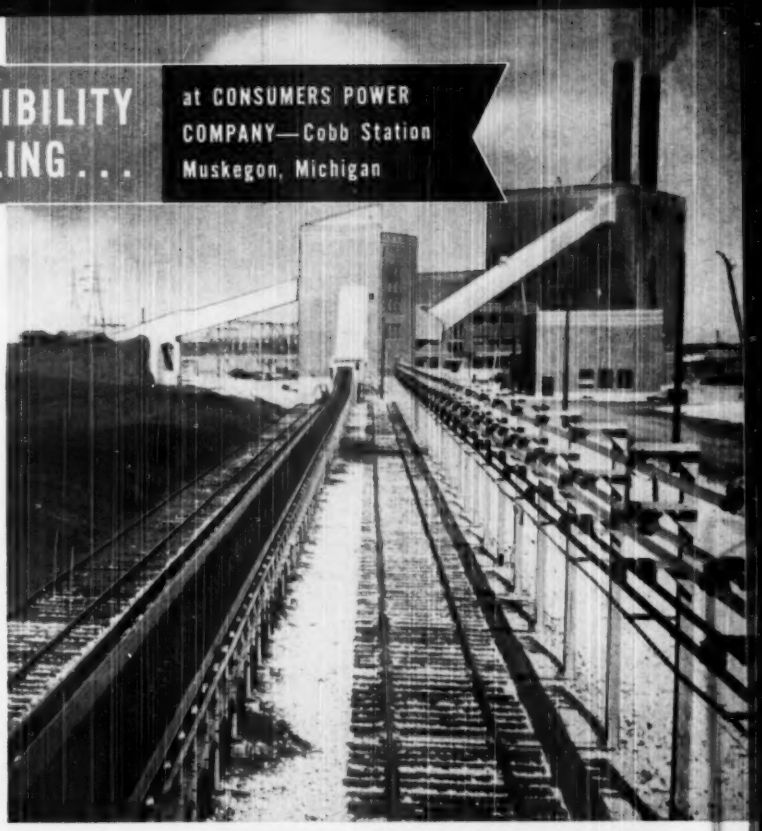
MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

LEEDS & NORTHRUP CO.

POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer" and "The Stationary Engineer"), September 1950, Vol. 94, No. 9. Published monthly with an additional Directory number in June. McGraw-Hill Publishing Company, Inc. Editorial and executive offices, 330 West 42nd Street, New York 18, N. Y. Entered as second class matter January 26, 1949, at the post office at New York, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least ten days for change of address. Subscription rates—U. S. and U. S. Possessions $5 for one year, $7 for two years, 65c per copy. Canada $7 for one year, $11 for two years. Pan American Countries, $10 for one year, $16 for two years. All other countries $15 for one year, $25 for two years. Please indicate position and company connection on all subscription orders.

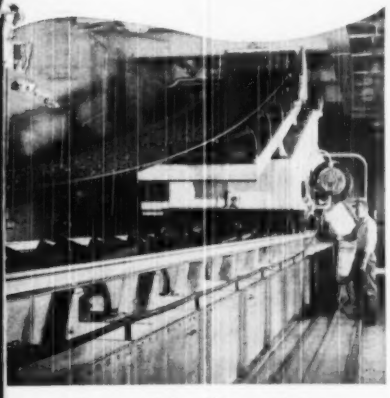
CONVENIENT FLEXIBILITY in COAL HANDLING . . .

at CONSUMERS POWER COMPANY—Cobb Station Muskegon, Michigan



View of the yard conveyor carrying coal to the feeder conveyor in the breaker house, thence to the coal bunkers.

The Link-Belt motor-driven, traveling tripper with stack conveyor removes all or any part of the coal from the 1230-foot-long yard conveyor.



A close-up of the 42" wide belt conveyor and the Link-Belt motor-operated, traveling tripper distributing the coal to the bunkers. Note the plow on the discharge chute which opens and closes the bin seals for maximum dust confinement.

LINK-BELT COAL-HANDLING SYSTEM INCORPORATES SELECTIVE HANDLING, STORAGE AND RECLAIMING

At this new, modern generating station the coal is brought to the dock in bulk freighters and in self-unloading boats. From the bulk freighters the coal is carried by crane to a feeder belt conveyor, thence to a transfer belt conveyor. The self-unloading boats discharge through a hopper to the transfer conveyor.

This transfer conveyor, with two speeds, carries 1200 or 1800 tons an hour to the open-belt yard conveyor which is 1230 feet long and has a choice of three speeds, two for unloading the boats, and one for reclaiming coal from storage. For storing coal, a motor-driven traveling stacker removes the coal from the yard conveyor. In reclaiming, a crane loads the yard conveyor. By varying the speed of the feeder from the reclaiming crane, coal from the boats and storage can be mixed in any desired proportion.

The yard conveyor also discharges through a chute on to a feeder in the breaker house. From this feeder the coal passes through a magnetic separator and either through or by the breaker to the plant conveyor where a Link-Belt traveling tripper distributes it to the bunkers.

A reclaiming hopper, feeder, and conveyor to the breaker house is available for reclaiming coal from storage in case of failure of the reclaiming crane.

This is a good example of Link-Belt engineering in modern coal handling. Link-Belt equipment and "know how" may be the way out of your coal-handling difficulties — whether in a public utility or industrial power plant. A modern system engineered to meet specific conditions does cut handling costs. Why not ask our nearest office for more particulars.

LINK-BELT COMPANY

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices in Principal Cities.

12.504

LINK-BELT

COAL and ASHES HANDLING EQUIPMENT

LINE UP for low-cost steam...
with the B&W Type E Pulverizer

Five B&W Type E Pulverizers, serving a B&W Radiant Boiler of 800,000 lb. per hr. steam capacity.

RECIRCULATING LOAD—DRIES AS IT GRINDS

Recirculation of fines within the mill gives repeated, quick-drying contact with large masses of heated air and metal... produces proper fineness at all loads, even with coal as wet as it can get. Fines are classified in the mill.

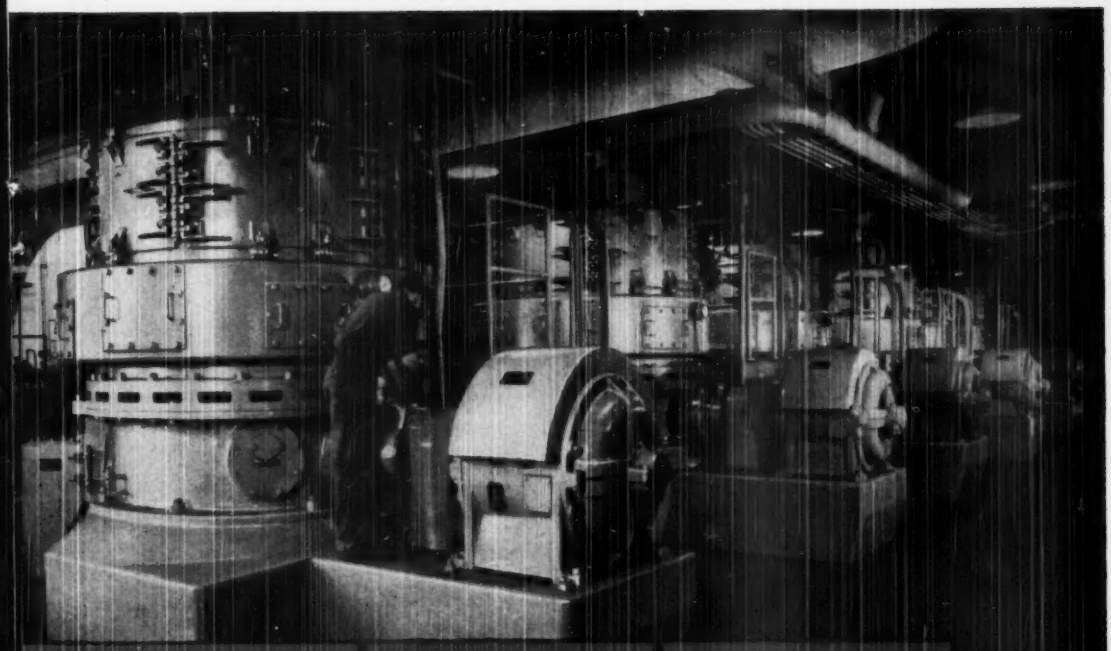
UNIFORM PERFORMANCE REGARDLESS OF WEAR

Balls and grinding rings wear together... assure uniform fineness regardless of attrition of the grinding elements . . . fineness automatically increases at reduced loads.

BLOWS CLEAN AIR—SAVES WEAR AND TEAR

Unique in pressurized operation, the Type E Pulverizer requires remarkably little maintenance of the primary fan, because it blows only clean air . . . is not subject to the damaging abrasion of entrained particles.

New Bulletin G-57 illustrates and describes the design, construction, operating and maintenance features of the Type E Pulverizer. Write: The Babcock & Wilcox Company, 85 Liberty Street, New York 6, New York.



ONE-POINT VARIABLE FUEL-AIR CONTROL

Like the accelerator on your automobile . . . assures proper coal-to-air mixture . . . produces desired rate of steam generation over a wide range with coal conditions suitable for sustained high combustion efficiency.

LOW POWER CONSUMPTION

Ball-and-ring grinding, anti-friction bearings, pressure lubrication, and automatic rejection of ungrindable materials make possible high output with minimum power demand.

OUTSTANDING PERFORMANCE RECORD

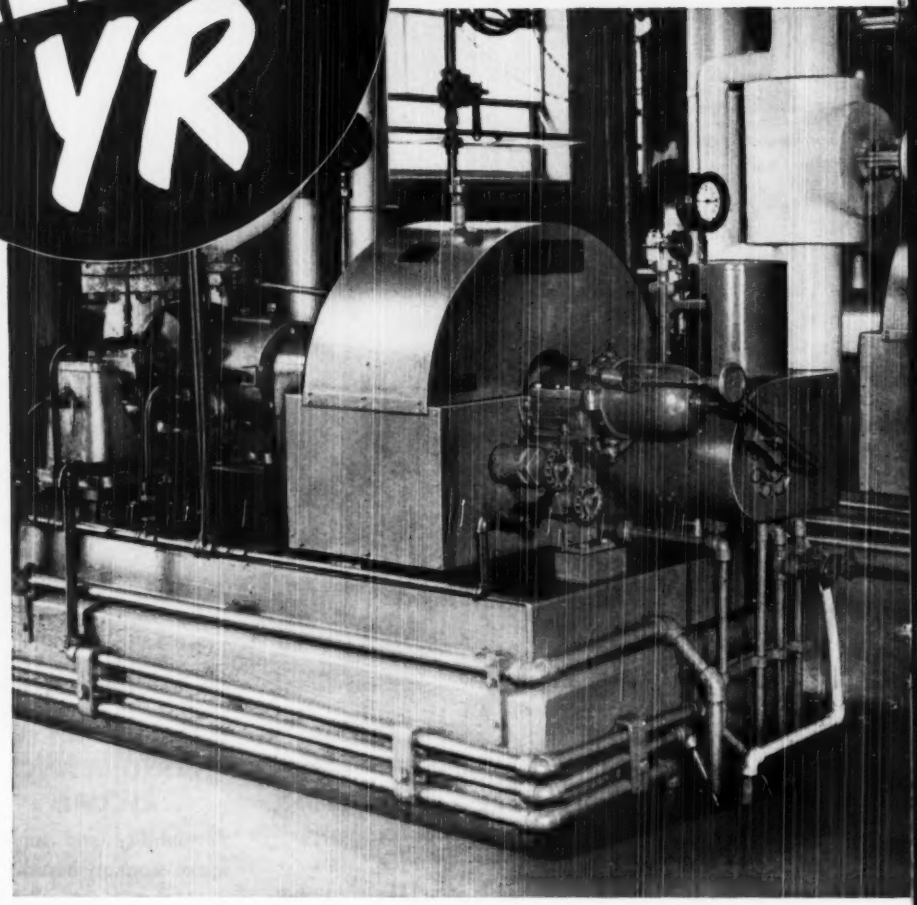
Availability and maintenance economy beyond today's most exacting requirements are proved in over 1300 Type E Pulverizer installations.

Helping Industry Cut Steam Costs Since 1867

BABCOCK & WILCOX

G-504T

ELLIOTT YR *the Turbine*

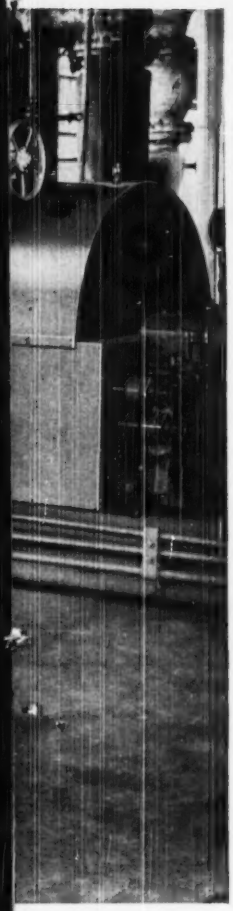


Elliott YR turbines may be furnished, when so specified, with carefully tailored, neat appearing, and readily removable jacketing, as in this installation.

ELLIOTT COMPANY

STEAM TURBINE DEPT.
JEANNETTE, PA.
Plants at: JEANNETTE, PA. • RIDGWAY, PA.
AMPERE, N. J. • SPRINGFIELD, O. • NEWARK, N. J.
DISTRICT OFFICES IN PRINCIPAL CITIES

that has everything!



1 ADAPTABILITY— Every plant engineer wants turbines tailored to his needs—if he can get them. In the YR, he can—and without sacrifice of standardization. Permissible modifications cover the widest possible range. Actually, eight types of turbines are available on five basic frames . . . one basic design of governor valve, six elective types of governor . . . several types of speed changer, emergency tripping mechanisms . . . gland seal arrangement for condensing operation and for operation with gas . . . with these and a number of other modifications practically any requirements can be met.

2 RELIABILITY— Here is a quality for which Elliott turbines have long been renowned. In the YR, this quality has been further enhanced by improving manufacturing facilities and details of design upon which reliable operation depends.

3 ECONOMY— Added to the operating saving in using a turbine practically built for its specific conditions, is the further direct saving in the reduction in stocking replacement parts due to the interchangeability of wearing parts on all frame sizes. One of the benefits of standardization.

4 REPUTATION— The high standing which Elliott turbines have earned everywhere is the best safeguard an engineer can have to sustain his selection of YR turbines. As one engineer said to another who had been having drive troubles, "Why don't you put in Elliott turbines and stop worrying?" In this he voiced an opinion almost universally held.

Whatever you want in a mechanical drive turbine you can get in a YR. Bulletin H-16 has all the details—write for it.

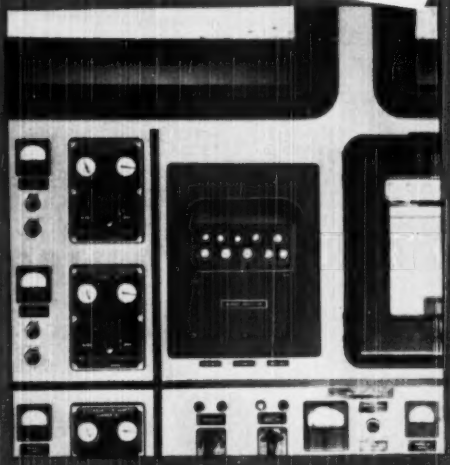
M-729

STEAM TURBINES • GAS TURBINES • GENERATORS • MOTORS • CONDENSERS
FEEDWATER HEATERS AND DEAERATORS • STEAM JET EJECTORS
CENTRIFUGAL BLOWERS • TURBOCHARGERS FOR DIESEL ENGINES
TUBE CLEANERS • STRAINERS • EXPANDERS • FILTERS

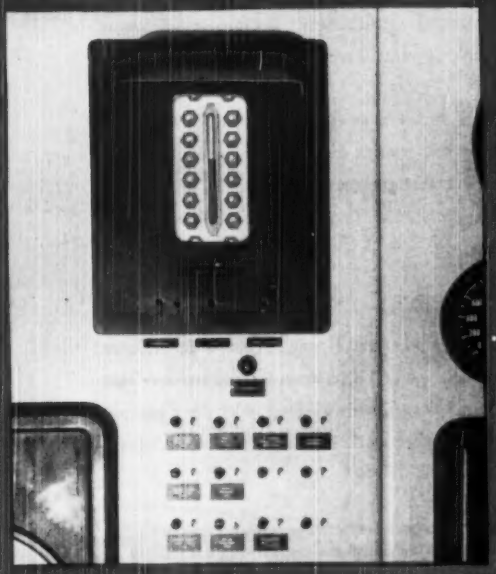
AT PHILIP SPORN PLANT*:

Diamond "Utiliscopes" Increase Safety and Operating Efficiency

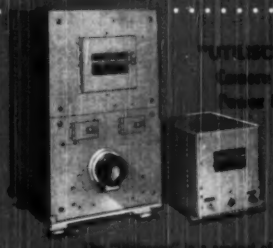
TELEVISION IN INDUSTRY



CHECKING PILOT BURNER FLAME CONDITIONS



READING BOILER DRUM WATER LEVEL



"UTILISCOPE" Camera and Power Unit

DIAMOND POWER SPECIALTY CORP.
LANCASTER, OHIO
Diamond Specialty Limited • Windsor, Ontario

AT PHILIP SPORN PLANT*:

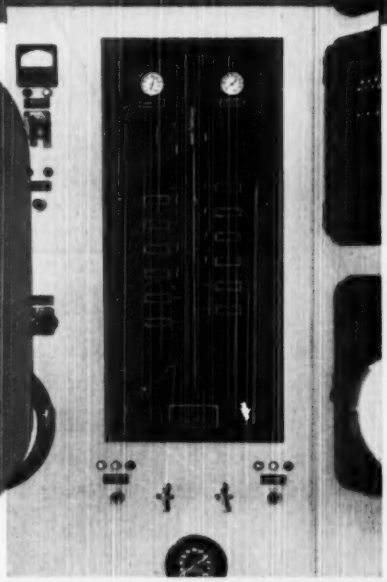
DIAMOND AUTOMATIC SEQUENTIAL SOOT BLOWING SYSTEM provides correct cleaning at minimum cost

The "human element" is eliminated from boiler cleaning by the Diamond Automatic Sequential Soot Blowing System. All blowers operate in proper sequence and at correct blowing speed every time . . . no blower can be overlooked or incorrectly operated by a careless operator. In addition to improved cleaning, there is a saving in labor as an attendant is not required by automatic operation.

At Philip Sporn Plant, Diamond Soot Blowers of various types are used according to furnace location and service required. All blowers are controlled by the control panel shown at the right. To do the complete blowing job the control room operator merely moves a lever. The control panel takes over . . . operates each blower or group of blowers correctly and in turn. On completion of the blowing cycle the panel automatically shuts off. For further information on the many advantages of Diamond Automatic Sequential Soot Blowing Systems, ask for Catalog 1014.

DIAMOND AUTOMATIC SEQUENTIAL AIR CONTROL PANEL

Controls automatic cleaning cycle of any arrangement of the various types of blowers. Operator starts cycle simply by moving start and stop valve carrier to the down position. Traveling upward, it operates each selected unit or group in turn and shuts off when all cleaning cycles are completed. Shows at a glance the unit in operation and those that have operated. No electrical connections of any kind.



*Part of the American Gas and Electric Company System.

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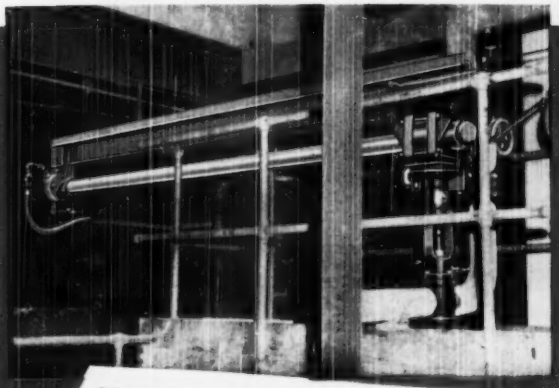
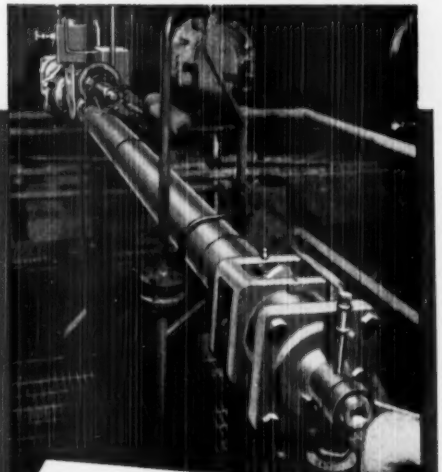


DIAMOND MODEL IK LONG RETRACTING SOOT BLOWERS



DIAMOND TELESCOPIC LONG RETRACTING SOOT BLOWERS

How to the Efficiency Boiler-Room

Before you get steam you've got to spend dollars—so dollars are a form of energy.

And if your boiler-room dollars are invested in equipment that isn't working efficiently, economically, your "investment" is poor.

That's where co-ordinated controls by Bailey can help. Here's why they'll increase your "boiler-room investment efficiency":

1. **Complete Range of Equipment—fully co-ordinated.** You need never worry that a Bailey Engineer's recommendation is slanted in favor of a particular type of equipment, just because he has a limited line to sell—or that Bailey will pass the buck for efficient control; we offer *complete* boiler control systems.

2. **Engineering Service—backed by experience.** No other manufacturer of instruments and controls can offer as broad an experience, based on successful installations involving all types of combustion, flow measurement and automatic control.

3. **Direct Sales-Service—conveniently located near you.** Bailey Meter Company's sales-service engineers are located in more industrial centers than those of any other manufacturer of boiler control systems; you get prompt, experienced service with a minimum of travel time and expense.

•

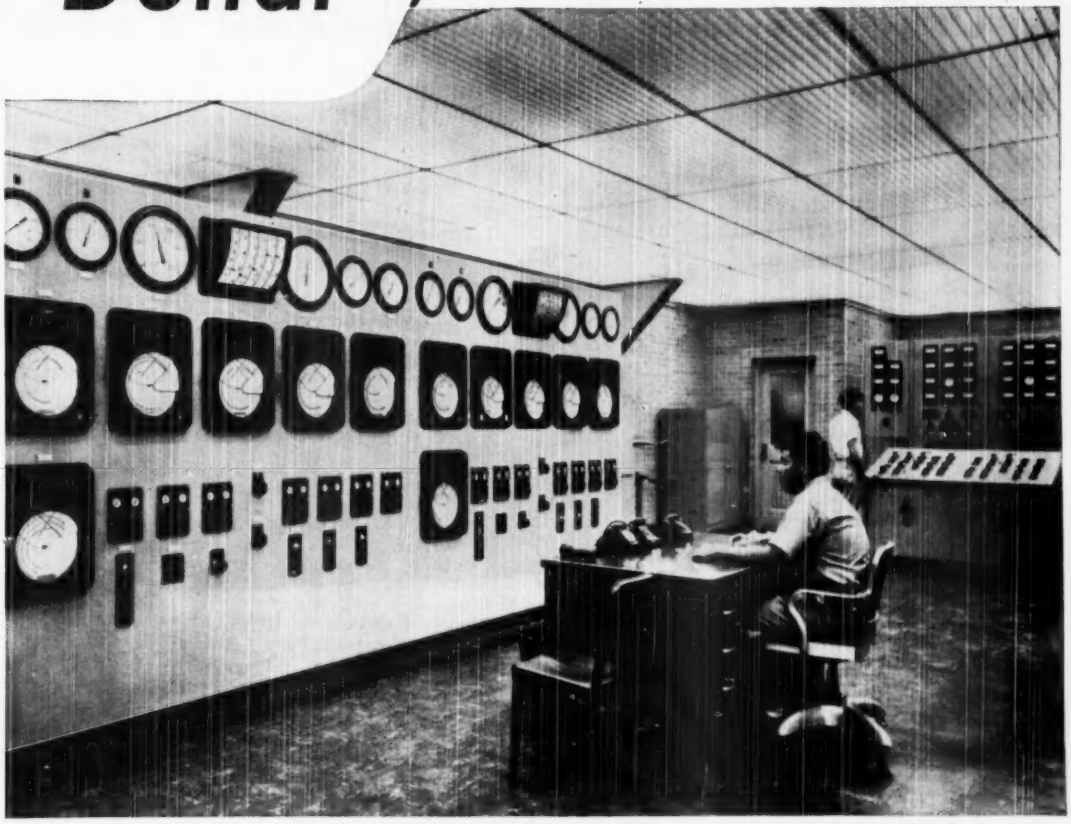
For better "boiler-room investment" efficiency—for more power per fuel dollar, less outage and safer working conditions, you owe it to yourself to investigate Bailey Controls. Ask a Bailey engineer to arrange a visit to a nearby Bailey installation. We're proud to stand on our record: "More power to you!"

111-1

Controls for Steam Plants

COMBUSTION • PRESSURE
FEED WATER • LIQUID LEVEL
TEMPERATURE • FEED PUMPS

INCREASE of YOUR Dollar



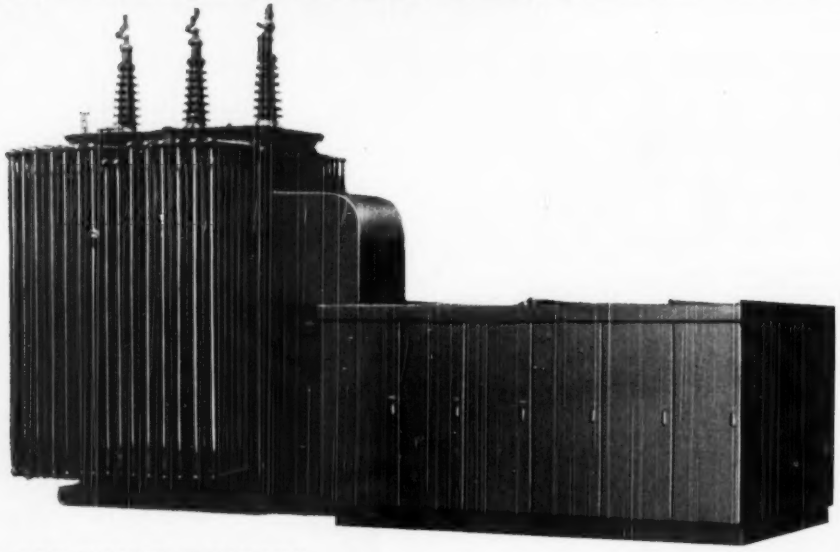
These Bailey Boiler Controls for Combustion, Feed Water, and Steam Temperature insure efficient operation of two 450,000 lb per hr, 1000 psi, 900 F, gas and oil fired boilers.

BAILEY METER COMPANY

1036 IVANHOE ROAD • CLEVELAND 10, OHIO
BAILEY METER COMPANY, LIMITED • MONTREAL, CANADA

BAILEY METERS

UNIT SUBSTATION *over* FIELD-ASSEMBLED TYPE



Typical G-E Master Unit Substation

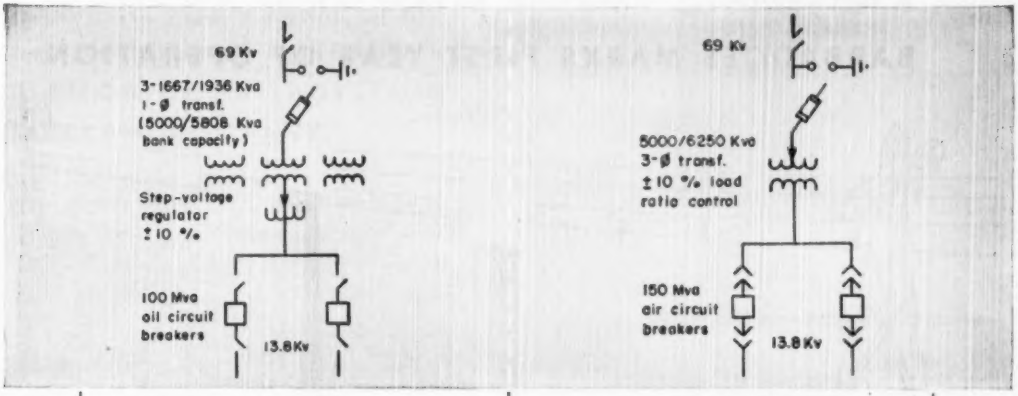
HERE ARE OTHER SAVINGS.....

When you order General Electric Unit Substations your engineering involves only a simple one-line diagram like the one at the right. We do all the detailed specs, prepare construction drawings, electrical diagrams, operating instructions and other paper work to give complete co-ordination of the project—all this on one purchase order, and at lower costs than field-assembled types.

For further information ask your G-E Sales Representative for the publications listed or write to *Apparatus Department, General Electric Company, Schenectady 5, New York.*

Master Unit Substations	GEA-3800
Single-circuit Unit Substations	GEA-4300
Package Substations	GEA-4500
Rural Package Substations	GEA-5276

SAVES 8.7%



FIELD-ASSEMBLED TYPE	
MATERIAL AND LABOR	$66,182
OVERHEAD (20%)	13,236
	$79,418

G-E UNIT SUBSTATION	
MATERIAL AND LABOR	$60,424
OVERHEAD (20%)	12,085
	$72,509

SAVINGS by installing G-E UNIT SUBSTATION $6,909 or 8.7%

In this typical cost analysis* that shows the obvious advantage of using General Electric Unit Substations purely from an investment standpoint, the labor estimates on both jobs were the minimum, a factor that favored the field-assembled type. As G-E Unit Substations arrive in large, completely-assembled units they are installed faster and easier, with lower labor costs.

Note that 20% overhead was added in both cases. For a comparison of *real costs,* 10% on the G-E Unit Substation against 20% on the field-assembled type would be more reasonable. Overhead is reduced when you order G-E Unit Substations because weeks spent in tedious engineering and detailing individual items are eliminated, at definite savings to you. Another item in favor of the G-E Unit Substation is its fan-cooled rating—442 kva greater than the field-assembled job. At a conservative $5 per regulated kva this gives you further savings in favor of the Unit Substation.

*For one installation in 1949.

MATERIAL AND LABOR	$66,182
OVERHEAD (20%)	13,236
EXTRA FAN-COOLED CAPACITY	2,210
	$81,628

LET'S EVALUATE

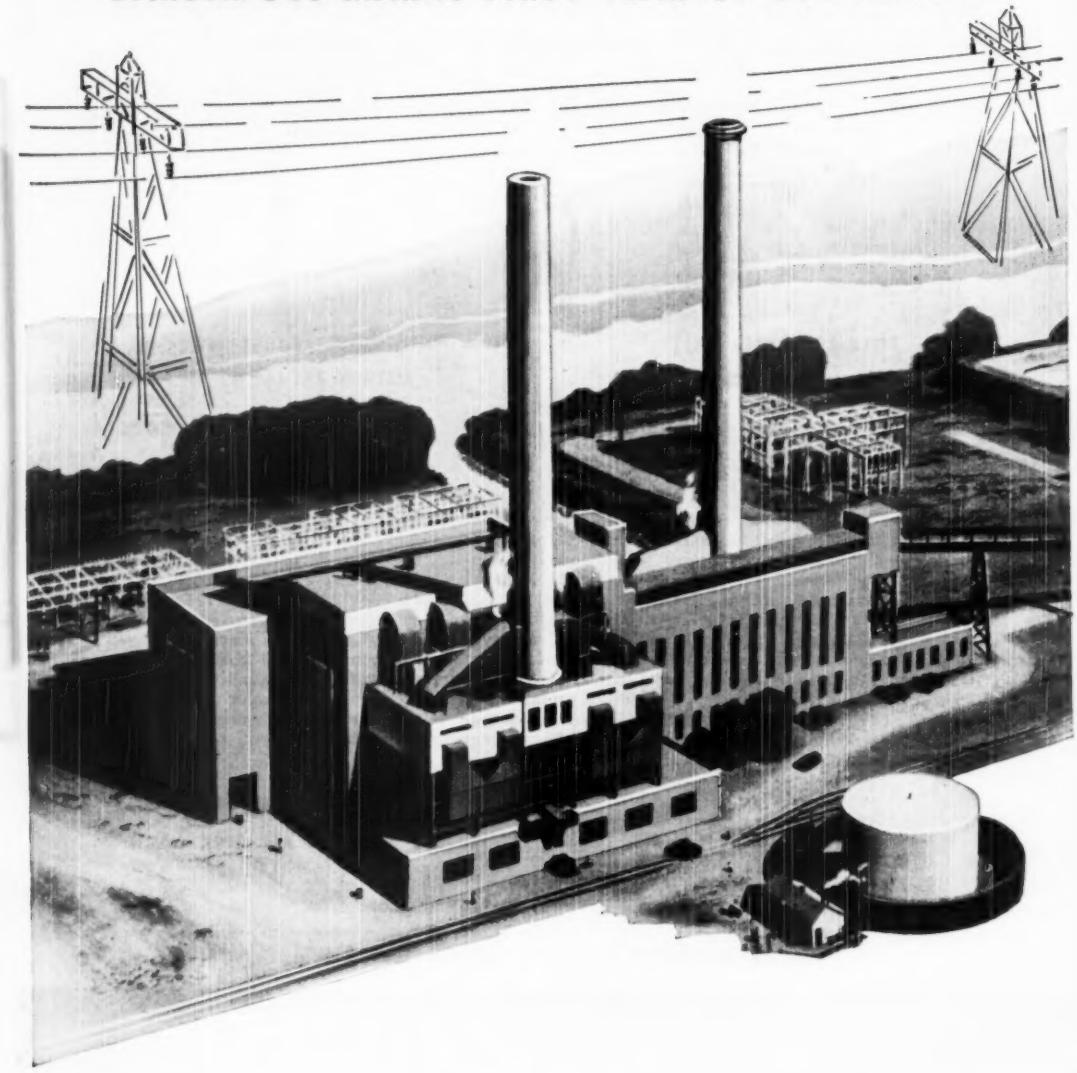
MATERIAL AND LABOR	$60,424
OVERHEAD (10%)	6,042
	$66,466

SAVINGS by installing G-E UNIT SUBSTATION $15,162 or 18.6%

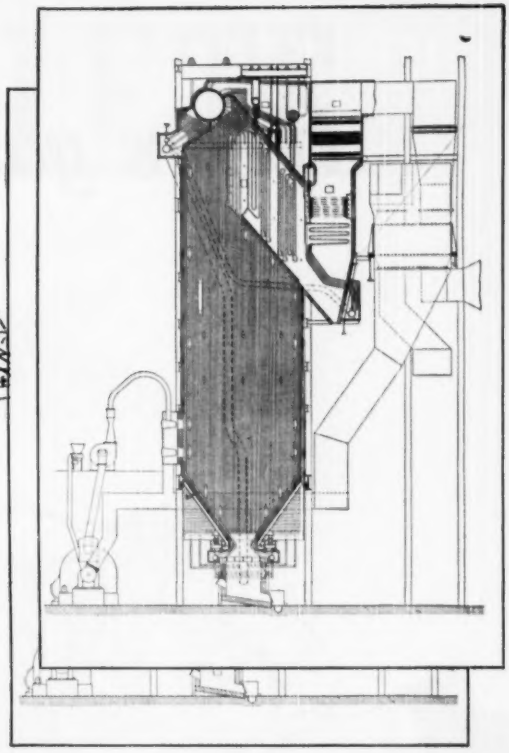
GENERAL ELECTRIC

running lines into the future

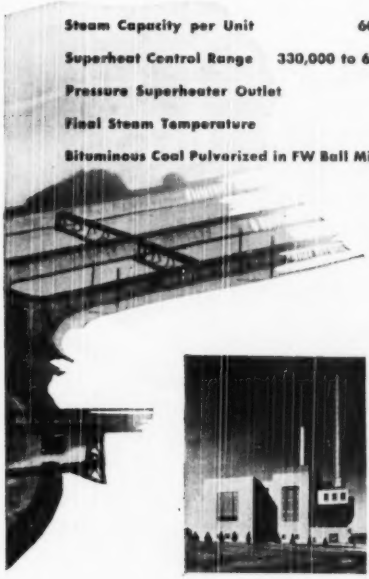
BARBADOES MARKS FIRST YEAR OF OPERATION



Two FOSTER WHEELER steam generators supply steam for the new turbines at BARBADOES STATION of PHILADELPHIA ELECTRIC COMPANY.



Steam Capacity per Unit	**600,000 lb per hr**
Superheat Control Range	**330,000 to 600,000 lb per hr**
Pressure Superheater Outlet	**825 psi**
Final Steam Temperature	**900 F**
Bituminous Coal Pulverized in FW Ball Mills (two per unit)	



The growth in the supply of electric power keeps pace with the rising population and productivity of Philadelphia's highly industrialized Schuylkill Valley since two 66,000-kilowatt turbo-generator units were installed a year ago in the $24,000,000 expansion of the Philadelphia Electric's Barbadoes Station. This station, which has a total capacity of 180,000 kilowatts — enough for the needs of 500,000 homes — is part of the Company's electric system covering an area of 2,255 square miles and serving more than 900,000 customers.

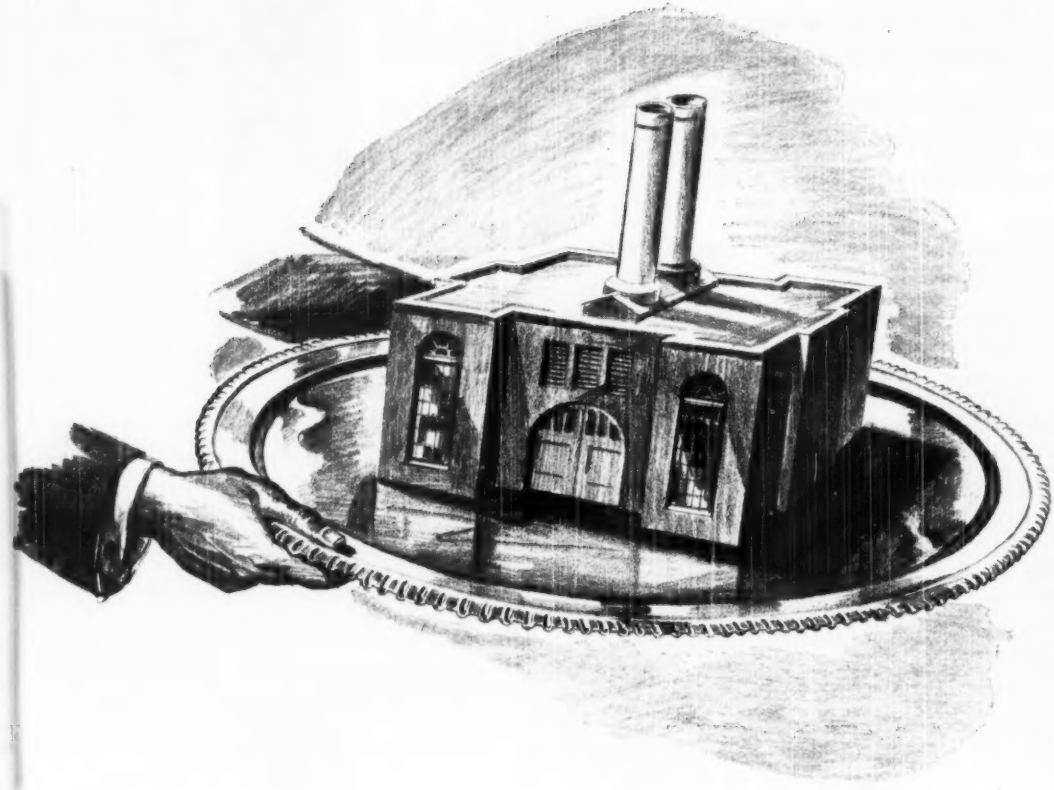
A total of 1,200,000 lb of steam per hr is supplied to the new turbo-generators by two Foster Wheeler Steam Generators which have a performance record proving the advantages of such Foster Wheeler design features as slag-free furnace arrangement, low draft loss, and efficient heat recovery arrangement. Each unit is fired by two Foster Wheeler Ball Mill Pulverizers with facilities to permit full load operation with coal or gas.

The most advanced techniques permit the handling of 12,000 tons of coal, 30,000,000 pounds of steam and 250,000,000 gallons of water each day at Barbadoes. Only 11 men per shift are required to operate the two new units and steam generators.

FOSTER WHEELER

FOSTER WHEELER CORPORATION • 165 BROADWAY • NEW YORK 6, NEW YORK

Here's your power plant ▸



Ask for a copy of 97-page Engineering Bulletin No. 44-B containing valuable information on steam generating plants and coal pulverization.

....COMPLETE...

ENGINEERED
INSTALLED
GUARANTEED

by KVS *for any solid fuel Anywhere*

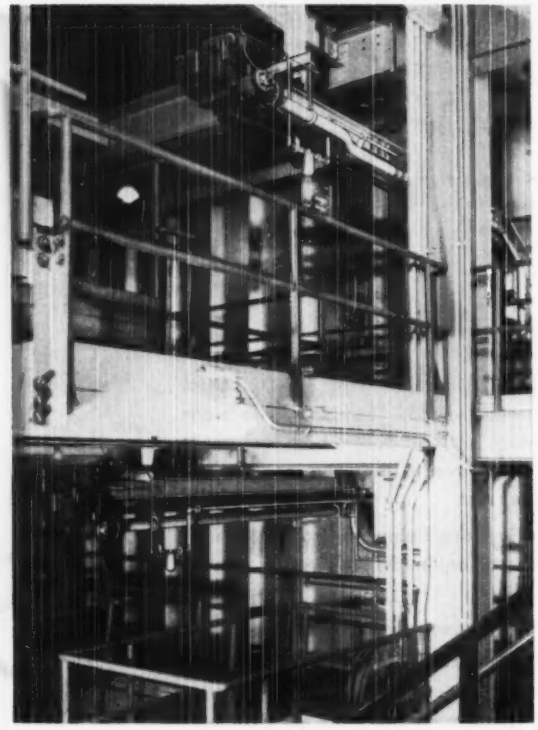
When we say, "your power plant" we mean just that . . . a plant that meets *your* specifications exactly . . . for *your* specific requirements. And when we say "complete," we mean every component, *whether or not built by KVS* to produce low cost power from low grade fuels . . . erected in any part of the World, ready to be turned over to its owners in full operation after all guarantees for performance shall have been met.

This unique service . . . from 'bunker to bus bar' . . . includes steam generators with all components, steam prime movers, electric generators and all equipment involved to provide a *complete* plant.

This unusual service by KVS contemplates the utilization of low grade solid fuels including tailings, washings, screenings, etc. to the end that low cost power can be assured wherever such fuels are available.

You are invited to consult with KVS engineers on any problem involving the generation of low cost power anywhere in the World.

It's VULCAN at RUSSELL STATION of Rochester Gas & Electric Corporation



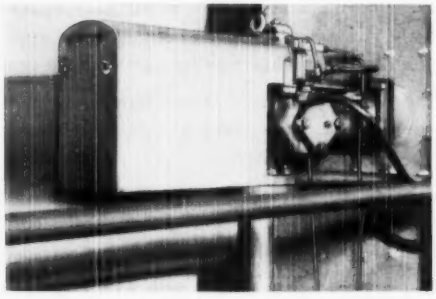
Vulcan long retractable soot blowers are built for travels up to 25 feet. They can blow with either steam or air without change in the equipment. Here are two of the four in service on Unit 1 at Russell Station.

For Automatic-Sequential Soot Blower Operation

20 pneumatic Vulcans—also using air for blowing—are combined in the automatic-sequential soot blowing system for Unit 1 at Russell Station of Rochester Gas & Electric Corporation, Rochester, New York.

The system includes eight waterwall de-slaggers, six rotary units, four long retractables and two air heater cleaners.

It takes no more effort than pushing a



One of the eight Vulcan waterwall de-slaggers installed on Unit 1. Like all other Vulcans on this unit, it blows with air compressed to 500 psig, and reduced to 275 psig.

VULCAN Automatic

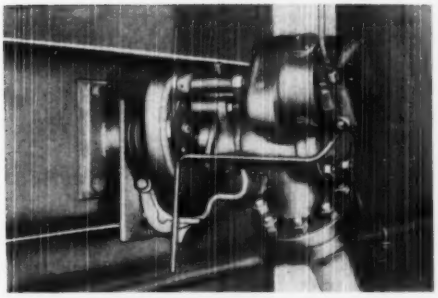
The boiler for Unit 1 at Russell Station was designed and built by Combustion Engineering-Superheater, Inc. Fired with pulverized coal, it is rated at 400,000 pounds per hour, with steam at 1300 psig and 915 degrees F. The C-E reheat boiler for Unit 2 has a capacity of 450,000 pounds per hour at 1800 psig and 1000 degrees F.

single button at the central control panel to start the automatic sequence. This saves time and labor.

Furthermore, each boiler section is effectively cleaned, and at the proper intervals. Soot and slag do not accumulate to decrease operating efficiency.

Unit 2—soon to be in operation at Russell Station—will also have a Vulcan Automatic-Sequential System.

VULCAN SOOT BLOWER DIVISION
Continental Foundry & Machine Company
DUBOIS, PENNSYLVANIA



Each of the six VULcomatic Rotary Soot Blowers on Unit 1 is designed to give effective cleaning over a maximum area, and to operate with a minimum of care, attention and maintenance.

At the panel, operators know from lights on the boiler diagram that each blower is operated in proper sequence. They can interrupt the automatic sequence at will, and go to individual blower control with push button.

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

NEW Large Induction Motors Cut Maintenance Costs 2 Ways

Ease of inspection . . . low-cost maintenance stand out in industry's new large motor—the Westinghouse ***Type CSF.***

Heading the list of cost-cutting features are sectional construction of end covers and air shields. Gone is the need for overhead cranes and costly, time-consuming operations. There's no top half of the bracket to remove . . . only the top half of the bearing housing.

Sectional covers can be removed from both ends of the motor in a few minutes for complete inspection, cleaning and other servicing requirements. The rotor and brackets need not be disturbed.

Split-sleeve bearings and oil rings make inspection or replacement easy. Simply remove the bearing housing cap. Bearings can be removed and replaced, by hand, without disturbing the bracket mounting.

Permanently aligned bearings assure proper air gap. The bottom half of the bearing housing is integral with the bracket, which is accurately machined and held in perfect alignment by a rabbet fit on the stator.

Added to these outstanding advantages are many other features that tell you these motors are built to do your job best . . . at lower cost. Get the facts from your Westinghouse representative, or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa.

J-21551

Westinghouse

LARGE INDUCTION MOTORS

Westinghouse **Type CSF** *Motors are available, squirrel-cage or* **Type CWF** *wound rotor, in four types: drip-proof, outdoor, splashproof and totally-enclosed, fan-cooled—in frame sizes 30 and larger, 4 or more poles.*

Who Buys VU-10 Boilers?

A quick answer is that VU-10 purchasers include industrials ranging from very small to the largest, as well as schools, hospitals, institutions, and, in fact, every type of establishment that requires boilers in the VU-10 capacity range. Why, then, limit the list of representative users on the opposite page to names known to everyone as among the biggest industrial enterprises in the country? Because such names form a significant guide for a prospective boiler buyer, in the same sense that the buying decisions made by operators of large truck fleets can be a reliable guide for the man who wants to buy a single truck.

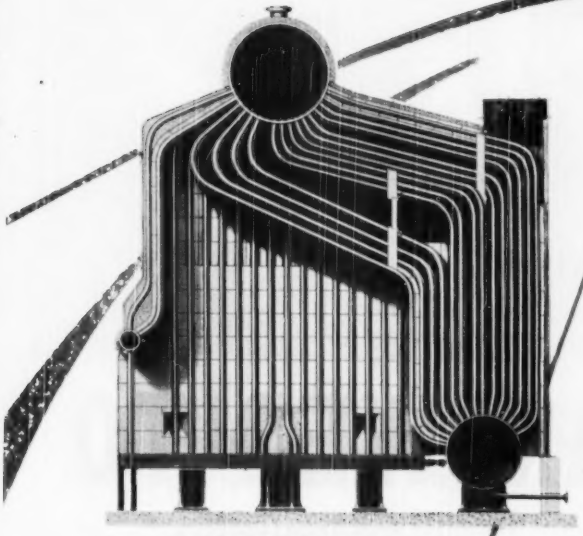
This reasoning applies *especially* to the purchase of a boiler. Big companies buy boilers frequently . . . therefore their experience is always up to date. They buy them for plants in many locations, using many different fuels. They buy them in capacities from very small to very large. Their requirements justify the employment of highly qualified engineering specialists—both staff men and outside consultants. Thus they have the breadth of experience and the expert guidance requisite to making the soundest equipment selections.

And perhaps equally important, big companies tend to place more emphasis on long-term operating and economic results. They know from their own experience that daily operating economies accruing through the years from better design and construction features will quickly offset the difference in first cost between the cheapest boiler they can buy and the best the market affords.

So if your steam requirements call for boilers in the capacity range from 10,000 to 60,000 lb of steam per hr, we submit the acompanying representative list of large companies that have purchased VU-10 Boilers as a sound reason for confidence that your decision to buy a VU-10 will prove to be a highly profitable one—not only for the first few years of service but throughout the lifetime of the installation. B-423

COMBUSTION ENGINEERING

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS



C-E Vertical-Unit Boiler

Type VU-10

The VU-10 Boiler is designed for industrial load conditions and particularly for plants having small operating and maintenance forces. Capacities range from about 10,000 to 60,000 lb per hr. Firing may be by spreader, underfeed, chain or traveling grate stokers, or by oil or gas burners. Superheater, economizer or air heater surface may be added if desired.

Representative large companies that have purchased VU-10 BOILERS

Air Reduction Company
American Locomotive Co.
Armour & Company
Borg Warner Corporation
Thomas A. Edison, Inc.
Ford Motor Company
Robert Gair Company
General Foods Corporation
B. F. Goodrich Chemical Co.
Illinois Packing Company
Johns-Manville Products Corp.
Jones & Laughlin Steel Co.
Liebmann Breweries, Inc.
Liquid Carbonic Company
National Distillers Chemical Co.
New York Central R.R.
Owens-Illinois Glass Co.
The Pennsylvania Railroad
Remington Arms Company
Revere Copper & Brass Co.
R. J. Reynolds Tobacco Co.
Joseph Schlitz Brewing Co.
Sharpe & Dohme, Inc.
Sunshine Biscuits, Inc.

— SUPERHEATER, INC.

200 MADISON AVENUE, NEW YORK 16, N. Y.

C-E

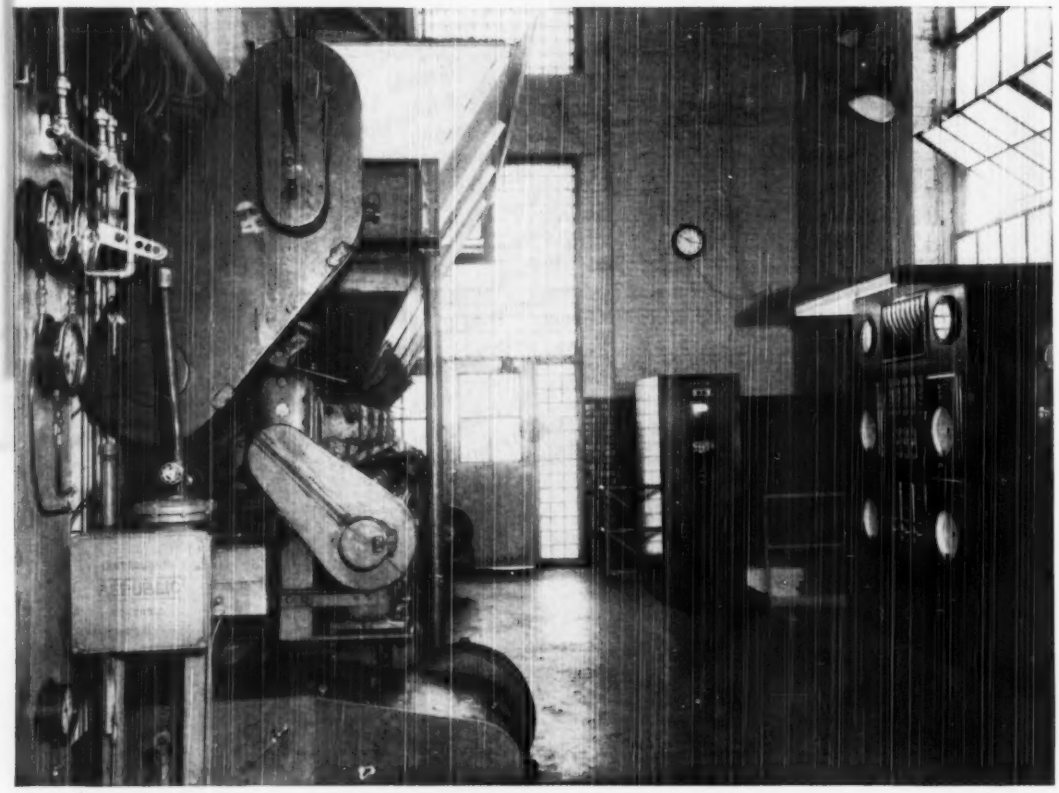
● the Municipal

Electric Light and Power Plant

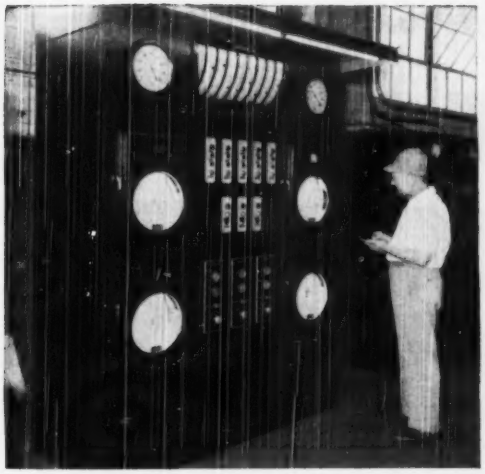
at Hannibal, Missouri

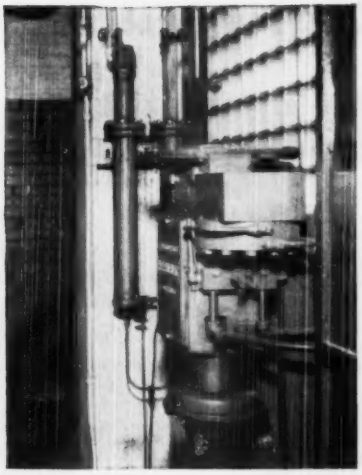
[the home of Mark Twain and his famous characters, Tom Sawyer and Huckelberry Finn]

HAS THE ANSWER TO



View of boiler room showing stokers and Republic boiler instrument and control panel.





Left: All essential boiler records and manual controls are centralized on the Republic boiler panel.

Right: Republic regulator controlling, in measured amounts, the air flow to the boiler.

LOWER STEAM COSTS

A REPUBLIC automatic combustion control system that operates their boiler at test standards, 24 hours a day, is the answer.

Installed at the Hannibal municipal plant is a modern three drum, 90,000 lb. per hour, 400 psi boiler with forced and induced draft fans and fired by a traveling grate spreader type stoker.

The REPUBLIC control system enables them to take full advantage of those economies which have been "built in" their boiler and its auxiliaries. It automatically increases and decreases simultaneously the fuel and air supply to the boiler in the correct amount to maintain constant steam pressure and in the correct ratio to maintain maximum combustion efficiency at all ratings.

The REPUBLIC combustion control system makes and co-ordinates these adjustments automatically, at the same time permits the operator to assume manual control from a centralized control point on the instrument panel whenever advisable.

REPUBLIC combustion control systems are designed and built for all sizes of boilers — all types of fuel firing — all load conditions and any arrangement of draft equipment. We will be glad to supply full information on REPUBLIC Control Systems — just write for Data Book No. S-21.

REPUBLIC FLOW METERS CO. ● 2240 DIVERSEY PARKWAY • CHICAGO 47, ILLINOIS

AT NEW YORK STATE ELECTRIC AND GAS CORPORATION . . .

it's ELECTRUNITE

Making preliminary beads in one of the many ELECTRUNITE Boiler Tubes used in the Jennison Station installation.

Resembling a corkscrew this ELECTRUNITE Boiler Tube proves its ability to take the severest bending with ease.

Combustion Engineering workmen, checking tube on floor template. Consistent uniformity of ELECTRUNITE Tubes assures ideal bending characteristics.

Lower section of completed Jennison Station boiler, showing modern ELECTRUNITE Boiler Tubes in place — ready to give years of dependable trouble-free service.

BOILER TUBES

in the SECOND Combustion Engineering Multiple Installation at Jennison Station!

Exterior view of Jennison Station's recently completed addition—built to house the two new generating units.

It was in December of 1945 that Jennison Station, Bainbridge, N. Y., came into being. A new, modern power plant dedicated to serving the electrical needs of South Central Area New York. The giant 30,000 kw turbine generator, receiving steam at 650 psi and 825° F. from two 200,000 lbs. per hour C-E steam generating units, poured out a flood of power . . . but, soon this wasn't enough! More and more power was demanded by this fast growing area. Today the need has been met with power a plenty for both present demands and future needs.

In May of this year, two more big generating units went into operation—with rugged, long-lived Republic Electrunite Boiler Tubes carrying the *maximum capacity load of 200,000 lbs. of steam at 675 psi and 893° F. temperature!* There are good reasons, why this manufacturer—and many others—use Electrunite Boiler Tubes. Uniformly high ductility throughout *every* tube . . . uniform straightness, concentricity, strength and soundness . . . freedom from rolled-in scale and scale pits are all features that add up to easy installation and long trouble-free boiler life.

Why not check into the advantages of Republic Electrunite Boiler Tubes for your equipment? We'll be happy to show you how you can profit—on new installations or replacements. Write, phone or wire us.

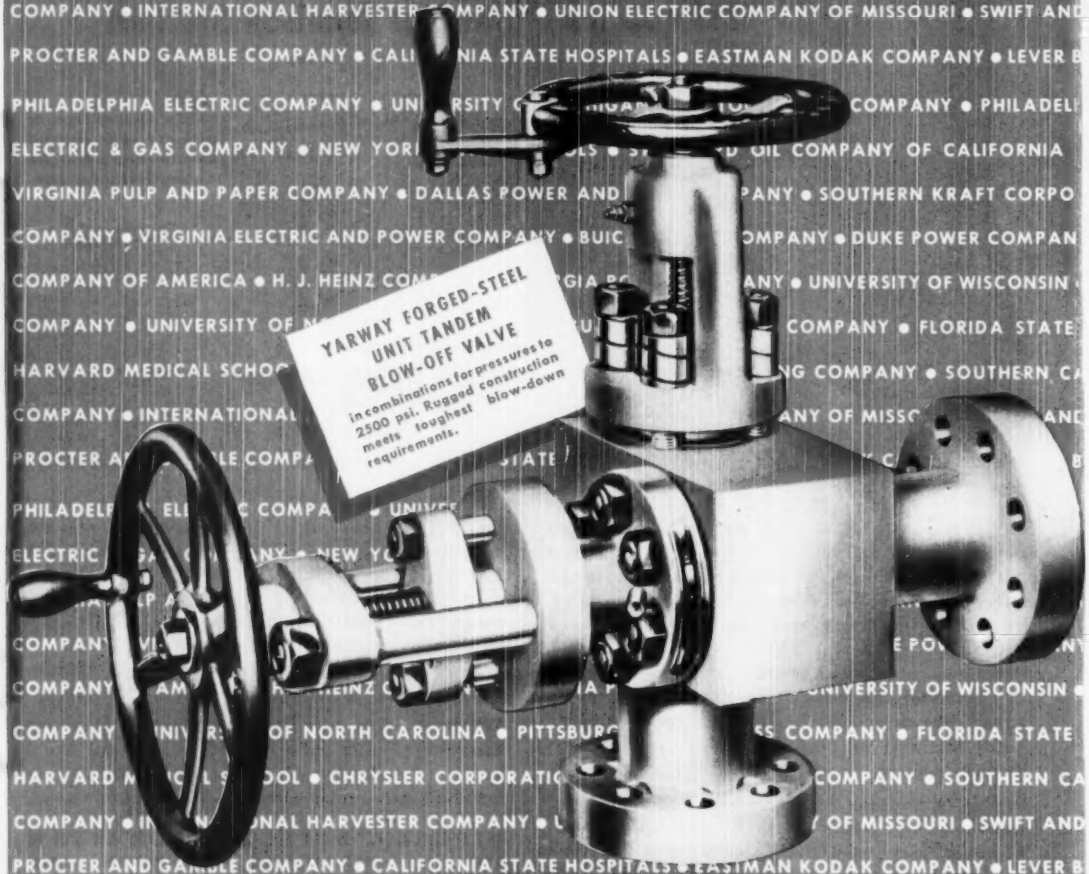
REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Export Department: Chrysler Building, New York 17, N.Y.

"INTESTINAL FORTITUDE",
a twenty minute movie that pictures the making of modern ELECTRUNITE Boiler Tubes is available for group showings . . . Write Republic Steel and Tubes Division if interested.

Republic
REPUBLIC STEEL
ELECTRUNITE
BOILER, CONDENSER AND HEAT EXCHANGER TUBES

A BLOW-

IS KNOWN BY THE


YARWAY FORGED-STEEL
UNIT TANDEM
BLOW-OFF VALVE
in combinations for pressures to 2500 psi. Rugged construction meets toughest blow-down requirements.

YARWAY

HIA PUBLIC SCHOOLS • PACIFIC GAS & ELECTRIC COMPANY • IOWA STATE COLLEGE • PUBLIC SERVICE
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COMPANY • FLORIDA POWER COMPANY • ARMOUR AND COMPANY • UNIVERSITY OF PENNSYLVANIA •

OFF VALVE BOILERS IT PROTECTS

When buying blow-off valves, weigh the significance of these two facts:

More than 15,000 boiler plants in the United States and other countries are equipped with Yarway Blow-Off Valves . . . Some of them for nearly 40 years. *Among high pressure plants, 4 out of every 5 in the United States are Yarway-equipped.*

Design, metallurgy, workmanship and service are the reasons. It was Yarway that brought out the famous Seatless Valve, teamed it with a stellited hard-seat valve in a common forged-steel body to make the popular Unit Tandem. Yarway has also made available metallurgical improvements to withstand the chemical reactions of acid wash as well as the mechanical wear of boiler blow-down.

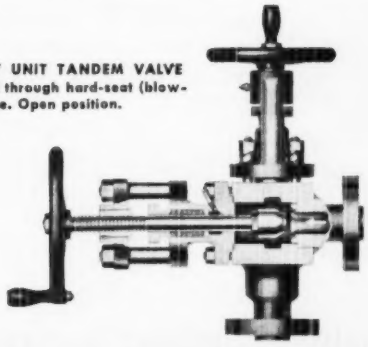
Yarway continues to pioneer and improve blow-off valves and blow-off valve service for both high and low pressure applications.

On new boilers, replacements or modernization, make sure you specify Yarway Blow-Off Valves. Any boiler manufacturer will supply them on your specification.

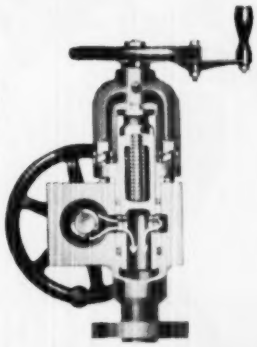
Bulletin B-424 gives you the full story on pressures to 400 psi. Bulletin B-433 for higher pressures. Both are free. Write . . .

YARNALL-WARING COMPANY, 100 Mermaid Ave., Philadelphia 18, Pa.

YARWAY UNIT TANDEM VALVE sectioned through hard-seat (blowing) valve. Open position.



YARWAY UNIT TANDEM VALVE sectioned through seatless (sealing) valve. Open position.



"We stopped both useless shutdowns and motor burnouts from Single Phasing by installing Fusetron fuses in a refrigeration compressor circuit"

Glenn F. Buschman, Manager
Kirby Risk Electric Motors, Inc.
Lafayette, Ind.

Mr. Buschman continues—

"In December '47 we rewound a motor for the Rund Packing Company of Lafayette, Indiana that had been burned out on single phase.

"One week later the same motor came back, again burned out on single phase.

"We investigated and found that the motor was used on the refrigeration compressor and that starting currents were causing the 100 amp. 250 volt renewable fuses protecting the circuit to blow. When one of them blew it single phased the motor.

"The thermals in the starter were oversize and so the motor burned up.

"100 amp. FUSETRON dual-element fuses were installed in place of the ordinary fuses and the thermals changed to the proper size.

"The thermals have so far never had to operate because the FUSETRON dual-element fuses stopped the useless blows on the starting current. This automatically stopped the single phasing that had previously caused the motor burnouts."

FUSETRON FUSES GIVE 10-POINT PROTECTION

TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION

BUSS

★ Fusetron fuses have high interrupting capacity. Tests conducted by the Electrical Testing Laboratories of New York City in December 1947 showed that on a 240 volt 60 cycle 3 phase, 4 wire circuit set to deliver 30,000 amperes, 30, 60, 100, 200, 400 and 600 ampere 250 volt Fusetron fuses on each and every test cleared the circuit without belching flame and with comparatively little noise.

1. *Protect against short-circuits.
2. Protect against needless blows caused by harmless overloads.
3. Protect against needless blows caused by excessive heating — lesser resistance results in much cooler operation.
4. Provide thermal protection — for panels and switches against damage from heating due to poor contact.
5. Protect motors against burnout from overloading.
6. Protect motors against burnout due to single phasing.
7. Give DOUBLE burnout protection to large motors — without extra cost.
8. Make protection of small motors simple and inexpensive.
9. Protect against waste of space and money — permit use of proper size switches and panels.
10. Protect coils, transformers and solenoids against burnout.

FUSETRON is a trade mark of the Bussmann Mfg. Co., Division of McGraw Electric Co.

Fusetron DUAL ELEMENT Fuses

Give All-Purpose Protection

because . . .

The fuse link element opens on short-circuit — the thermal cutout element protects on overloads — the result, a fuse with tremendous time-lag and much less electrical resistance.

They have the same degree of Underwriters' Laboratories approval for both motor-running and circuit protection as the most expensive devices made.

Made to the same dimensions as ordinary fuses — fit all standard fuse holders.

Obtainable in all sizes from 1/10 to 600 ampere, both 250 and 600 volt types. Also in plug types for 125 volt circuits.

Their cost is surprisingly low.

Don't Risk Losses

One needless shutdown
One lost motor
One destroyed switch or panel

may cost you far more than replacing every ordinary fuse with a FUSETRON dual-element fuse

MAIL THE COUPON NOW
for complete information about Fusetron Fuses and their 10-point all-purpose protection

Bussmann Mfg. Co., University at Jefferson St. Louis 7, Mo.
(Division McGraw Electric Co.)

Please send me complete facts about FUSETRON Dual-Element FUSES.

Name.....
Title.....
Company.....
Address.....
City & Zone..... State.....

710

The exteriors may look alike— but *what a difference inside!*

Inside one home, life goes on smoothly and harmoniously. But in the house next door there's constant friction and nerve-wearing turmoil.

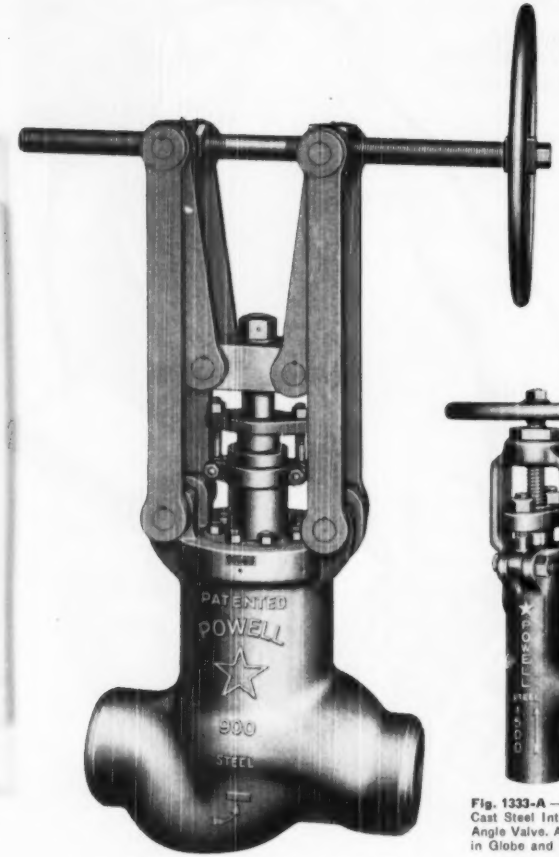


Fig. 19084 W. E.—Class 900-pound Cast Steel Pressure Seal Globe Non-return Valve with welding ends. Toggle operated. Improved streamline design reduces pressure drop and turbulence to the minimum.

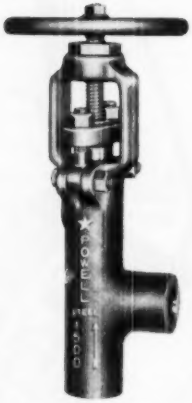


Fig. 1333-A — 1500 pound Cast Steel Integral Bonnet Angle Valve. Also available in Globe and "Y" types.

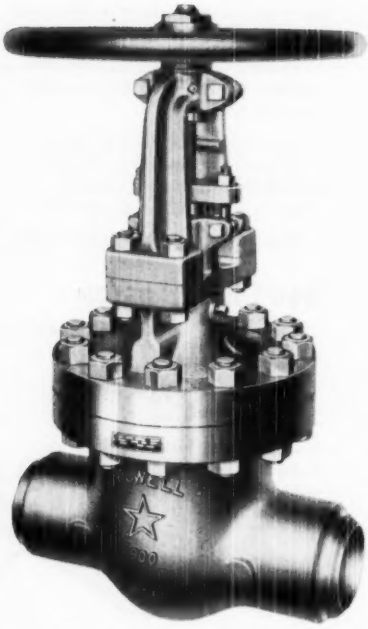


Fig. 9003 W.E. — Class 900-pound Cast Steel Gate Valve with welding ends, outside screw rising stem, bolted flanged yoke and tapered solid wedge.

POWELL

Compare the outside appearance of any standard Powell valve with that of any other valve of the same type and size. You will probably notice very little difference. But inside—that's another story.

There design, materials and manufacturing skills make the difference between a Powell Valve—built to operate smoothly and efficiently over a long period of time — and a valve that will have only a short life before it requires maintenance or even replacement.

Powell also makes many *exclusive* patterns to meet the requirements of special services. In these, too, long, trouble-free performance is a primary consideration.

Fig. 1793—Large 125-pound Iron Body Bronze Mounted Gate Valve. Made in sizes 2" to 30", inclusive. Has outside screw rising stem, bolted flanged yoke and tapered solid wedge.

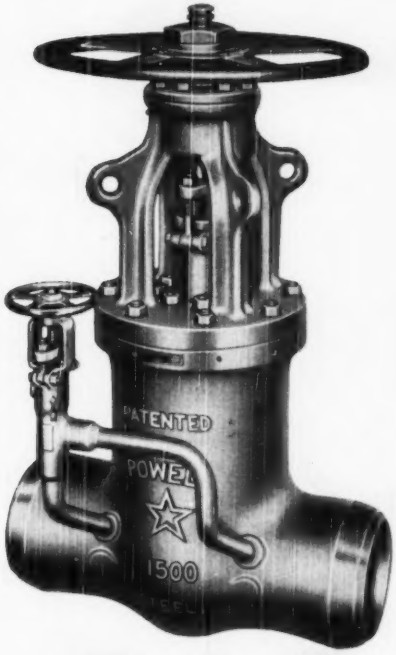


Fig. 11313 W.E.—Class 1500-pound Cast Steel Pressure Seal Gate Valve with welding ends and by-pass. By-pass is equipped with 1500-pound Steel Integral Bonnet Angle Valve.

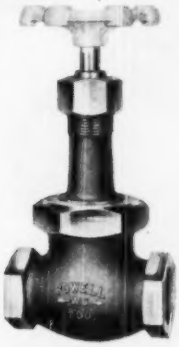


Fig. 2608—Bronze Globe Throttling Valve. Full flow through the seat when wide open. Has special bronze stem and stainless steel disc and seat hardened to approx. 500 Brinell.

Fig. 1365-A — Small size, 1500-pound, Steel Pressure Seal "Y" Check Valve. Angle Lift Check Valves also available.

The Complete Powell Line includes Globe, Angle, "Y", Gate, Check, Non-return, Relief, and Flush Bottom Tank Valves in Bronze, Iron, Steel and a wide range of Corrosion-resistant metals and alloys.

Ask your nearest Distributor—or write direct

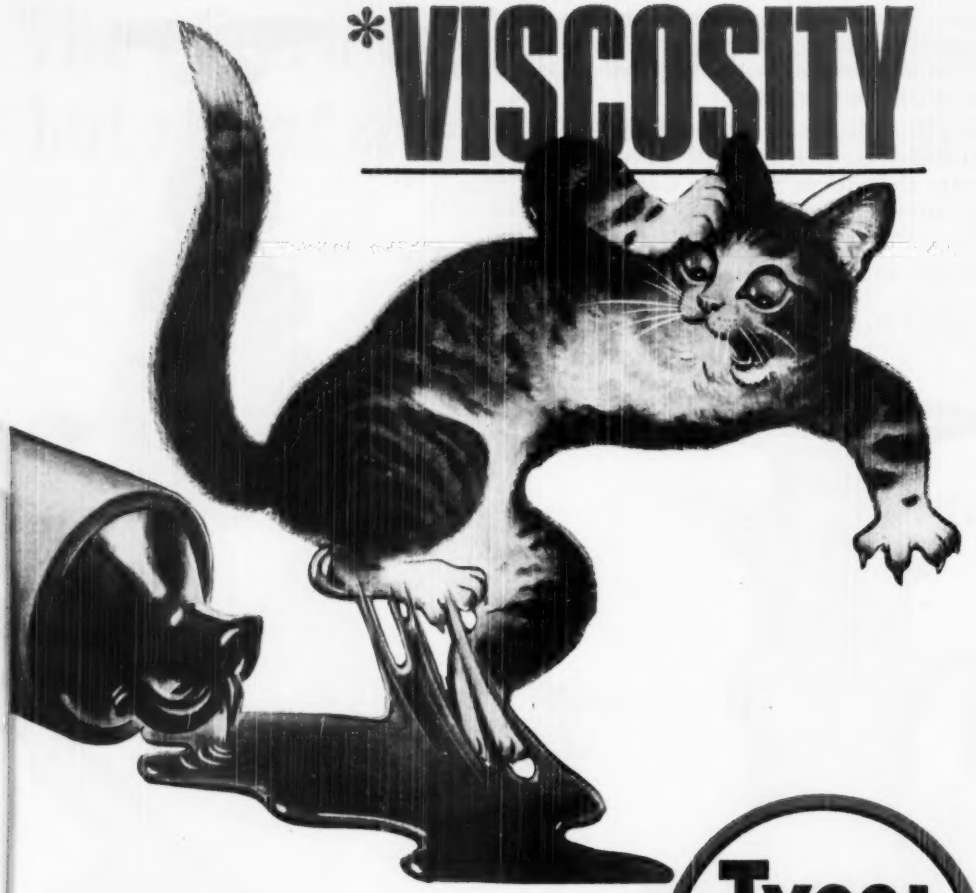
The WM. POWELL Co., 2525 Spring Grove Ave.

P. O. Box 106, Station B, Cincinnati 22, Ohio

DISTRIBUTORS AND STOCKS IN ALL PRINCIPAL CITIES

VALVES

*VISCOSITY



All equipment will last longer — give better service — if you use the proper lubricant. That's why you'll find it profitable to use Tycol high quality oils and greases.

There's a reason! No matter what your lubrication need — for roll neck bearings or mine cars, Diesels or high speed textile spindles, turbines, paper calenders or steam engines . . . where *VISCOSITY, penetration, extreme pressure is a factor — Tycol has a lubricant suited to your specific requirements.

Refined from selected crudes, Tycol lubricants are exceptionally resistant to breakdown which means greater economy . . . longer life for every type of equipment.

Let us show you the extra value in every measure of Tycol lubricants. Write your nearest Tide Water Associated office today.

TYCOL

INDUSTRIAL LUBRICANTS

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TIDE WATER ASSOCIATED OIL COMPANY

17 BATTERY PLACE · NEW YORK 4, N.Y.

*LEARN WHAT THIS PRODUCT CHARACTERISTIC MEANS TO YOU — READ "LUBRICANIA" This informative handbook, "Tide Water Associated Lubricania," gives clear, concise descriptions of the basic tests used to determine important properties of oils and greases. For your free copy, write to Tide Water Associated Oil Company, 17 Battery Place, New York 4, N. Y.

REFINERS AND MARKETERS OF VEEDOL — THE WORLD'S MOST FAMOUS MOTOR OIL

TRI CLAD MOTORS
REG. U.S. PAT. OFF.
will run safely without relubrication for as long as any general-purpose motor you can buy—
and if the application makes relubrication a must, you can grease a TRI CLAD without halting production
GENERAL ELECTRIC
HERE'S WHY

TRI CLAD MOTORS will run safely without relubrication for as long as any general-purpose motor you can buy—

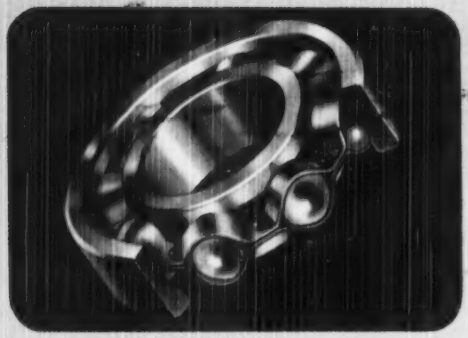
Tri-Clad extra lubrication "protection" can save you money because:

1. Tri-Clad's oversize grease reservoir and the heaviest standard-service bearings mean you do not have to bother with greasing between motor check-ups.

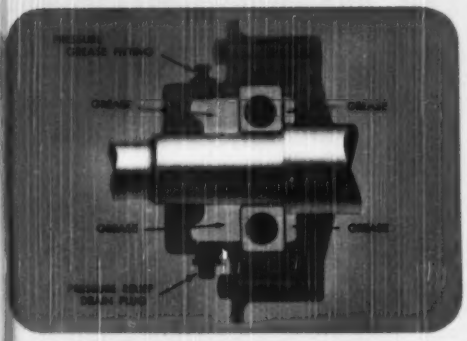
2. When relubrication is needed on those tough applications, you can grease a Tri-Clad without interrupting production-line operations.

Tri-Clads are grease-gun easy to lubricate *on the job*. Moreover, a Tri-Clad motor will run safely where an ordinary motor would fail. Chances are you'll be spared the cost of a "special" motor.

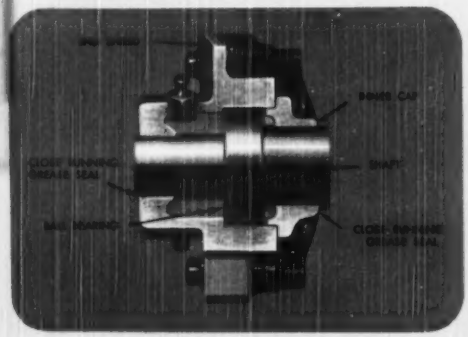
YOU BE THE JUDGE! The best way to prove to yourself that Tri-Clad gives you the most for your motor dollar is to contact your local G-E office. Tri-Clad stocks are complete. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*



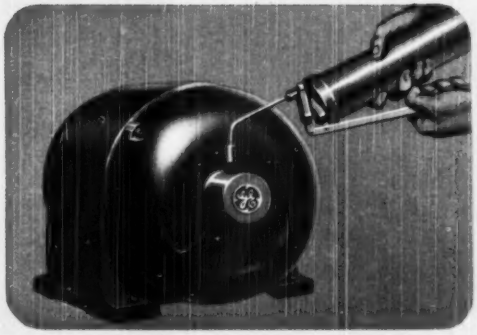
1 **EXTRA BEARING PROTECTION** — Tri-Clad gives you extra bearing protection because heaviest standard-service bearings are carefully selected to withstand severe loads for long periods.



2 **EXTRA GREASE** — Four times the ordinary amount of grease is packed into the large Tri-Clad grease reservoir. Since bearing life depends on grease, this means that Tri-Clad motors will run safely for years — for as long as any general-purpose motor you can buy.



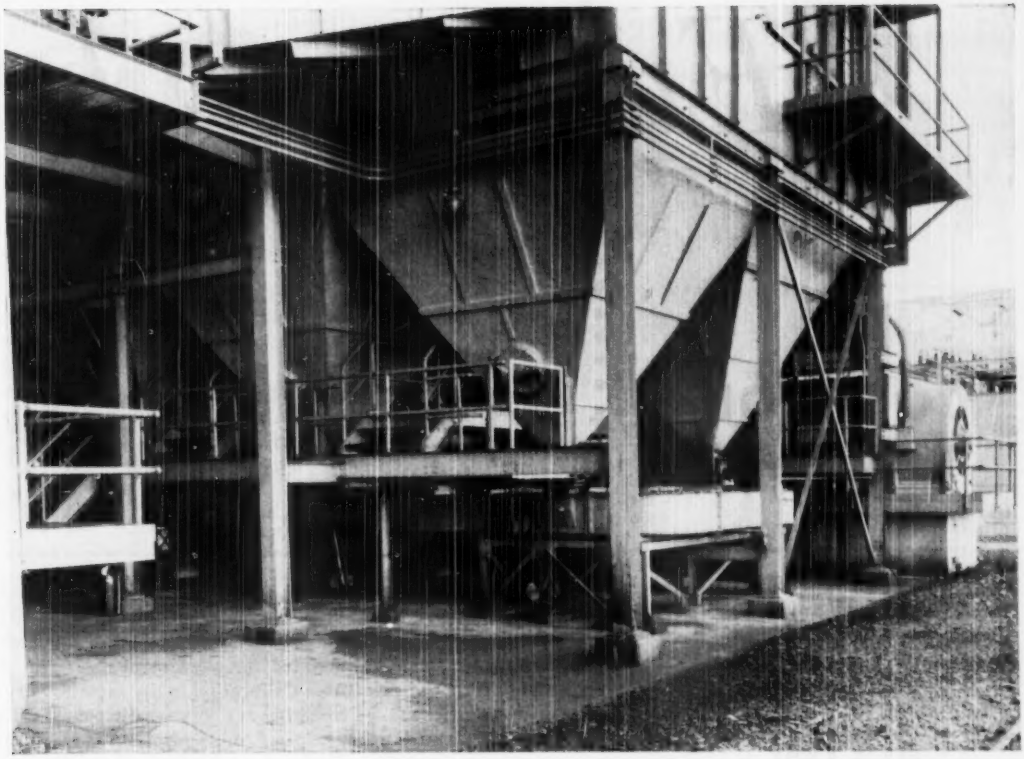
3 **SEALED-IN BEARINGS** — Bearings and grease are completely sealed in a cast housing with long running seals for extra protection from dirt, dust, and lubricant leakage.



4 **PRESSURE-RELIEF GREASING** — An efficient system of pressure-relief lubrication (with standard fittings) enables a Tri-Clad motor to be quickly and easily greased on the job when and if it's needed.

GENERAL ELECTRIC

732-3



SETTLING THE DUST NUISANCE
in Fly Ash Collection

Closed-circuit REDLER Conveyors provide a practical and economical answer to this power plant's need for handling fly ash in a neat and efficient manner. The sealed casings of this compact, flexible system—plus the recirculation feature—assure dustless collection from hoppers and delivery to dust pumps.

For jobs like this—and others of equally difficult specifications—Stephens-Adamson engineers have many answers—each designed for the specific installation. The complete S-A Line includes every type of bulk materials handling equipment for handling maximum tonnage at minimum cost.

When you plan a new handling unit or a conveyor system, draw on S-A engineers' nearly 50 years of experience with bulk conveying problems. You'll find this service helpful—particularly when conditions are difficult. Write today.

PUBLIC SERVICE ELECTRIC AND GAS COMPANY, SEWAREN, N. J.

Three horizontal closed-circuit REDLERS, each with a 25 ton per hour handling capacity, receive fly ash through rotary vane feeders mounted under each of thirty precipitator hoppers. The REDLERS are approximately 56 feet long and 12 feet wide. Each conveys around a circuit from multiple feed points to a single discharge outlet that delivers ash to a dust pump for subsequent disposal. Recirculation feature, which permits multiple feed and common discharge without clogging, is valuable . . . plus the fact that the REDLERS' compact, flexible advantages enable them to fit into alloted space.

STEPHEN S-A ADAMSON MFG. CO.

5 Ridgeway Avenue, Aurora, Illinois — Los Angeles, Calif. • Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

Equipment by

for CONTROL SYSTEMS

Hagan pioneered in the field of automatic combustion control systems for both stationary and marine boilers—and still leads. Engineering of these and other control systems is one of Hagan's major activities, but the components of these systems are suitable for many other applications, and may be purchased separately.

for FLOW MEASUREMENT

The Hagan Ring Balance Flow Meter is a rugged and accurate instrument, adapted for a wide range of static and differential pressures. Calibration is the same for dry or wet service; range changing is exceptionally easy. Suitable for water, steam, air, gas, oil, and other fluids. *No stuffing boxes.* Calibration by dead weight method checks or takes the place of water column methods. Photos show a few typical models of this meter.

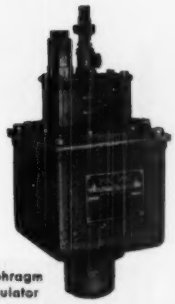
for FORCE MEASUREMENT and other purposes

As designers of control systems, Hagan engineers have on many occasions encountered problems which required the development of special equipment. Some of this equipment has proved to have a wider field than the original application, and has been made commercially available. Several such units are shown here.

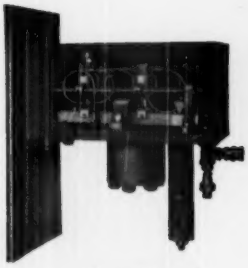
• • •

For full information on any of this equipment and its application to your specific problems, write to Hagan Corporation, Hagan Building, Pittsburgh 30, Pa.

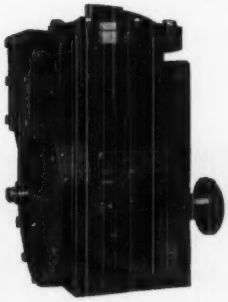
HAGAN



Diaphragm Regulator

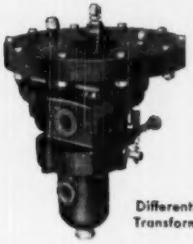


Type "F" Master Sender

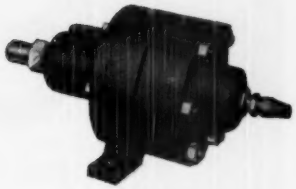


Variable Ratio Regulator

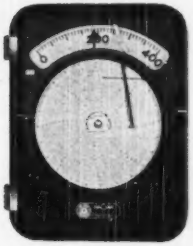
Receiving Regulator



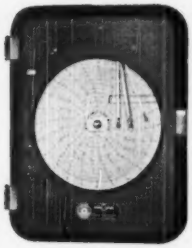
Differential Transformer



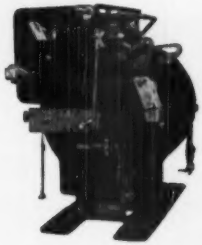
Type "F" Totalizer



Ring Balance Flow Meter (Indicating, Integrating & Recording)

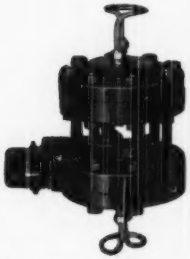


Ring Balance Flow Meter (Integrating & Recording)



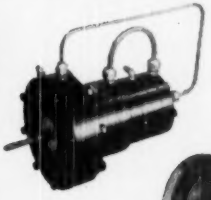
Dual Meter with Integrator (Case Removed)

Single Ring Meter without Integrator (Rear View)



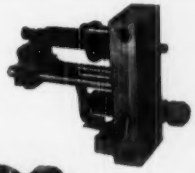
Hagan ThrusTorq

Steam Separator



MicroServo

V Port Butterfly Valve



MicroTrans

Thermostat

HAGAN CORPORATION

BOILER COMBUSTION CONTROL SYSTEMS
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
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All these catalogs of power generating equipment manufacturers are instantly available in Section No. 1 of your Sweet's File for Power Plants.

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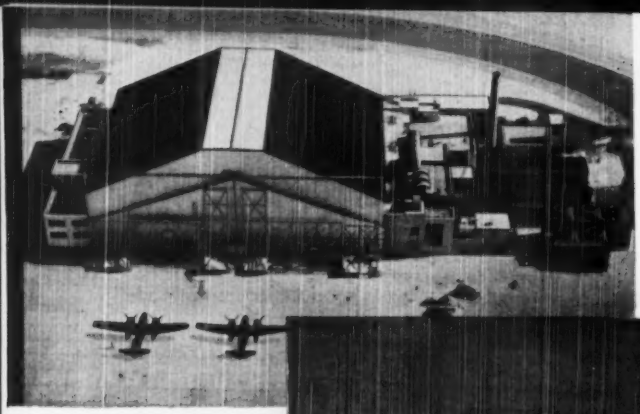

Whether the
COLD WAR
Simmers or Sizzles

WORLD'S LARGEST CLIMATIC TEST LABORATORY

Above
CLIMATIC HANGAR
Air Proving Ground
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EGLIN AIR FORCE BASE
FLORIDA

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SIZE OF HANGAR
200' x 250' x 70'

POWERS

Pneumatic Control Systems also used in—

ARMY SIGNAL CORPS CLIMATIC LABORATORY
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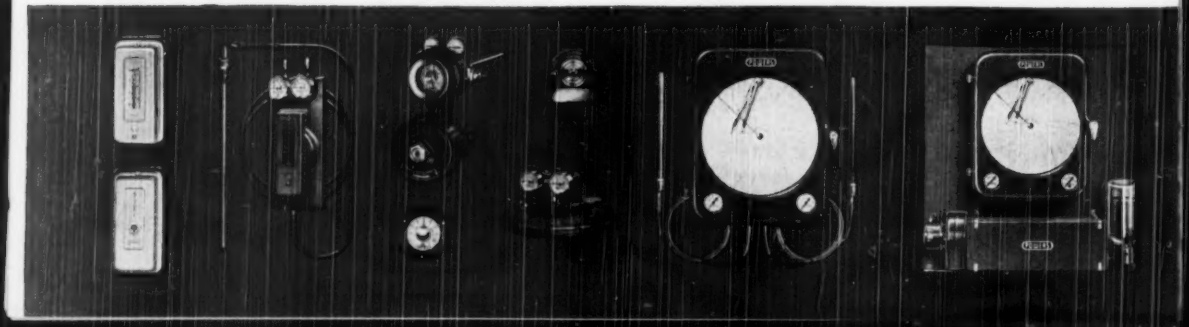
and many other prominent test laboratories

WEATHER CONTROL PANEL—POWERS Series 100 Recording Regulating Instruments, and pneumatic switches for remotely controlling air conditions in Climatic Hangar shown above.



POWERS Control Helps EGLIN Climatic Hangar Keep Cool

at 165°F. down to 65°F. Below Zero

Air Force Equipment Is Tested In All Kinds of Weather

Here at Eglin Air Force Base, Florida, "cold war" is waged against defective combat and ground equipment. In the giant hangar B-36's and smaller planes, tanks, housing and vehicles are tested in man made arctic blizzards, tropical hurricanes, jungle dampness or dry desert heat. Jet engines, weapons, men, food, clothing and photographic equipment are tested in smaller rooms.

Air conditioning control problems encountered here, presented an interesting challenge for POWERS engineers. Many years of experience gained in meeting the unusual demands of other prominent military, industrial, public and commercial buildings were helpful in providing the automatic controls required for this "World's Largest Ice Box"

We welcome an opportunity of helping you find the right solution to your problems of air conditioning control. Whether they be simple, complex, large or small you can benefit from our many years of valuable experience. Phone or write your nearest POWERS office.

THE POWERS REGULATOR COMPANY

Established 1891. Offices in Over 50 Cities, see your phone book

Chicago 14, Ill., 2721 Greenview Avenue • New York 17, N. Y., 231 E. 46th Street
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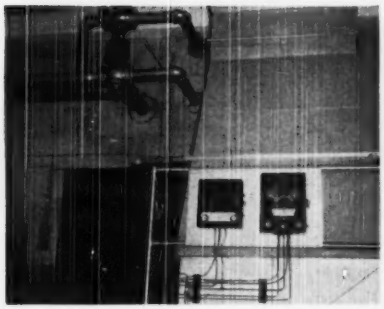
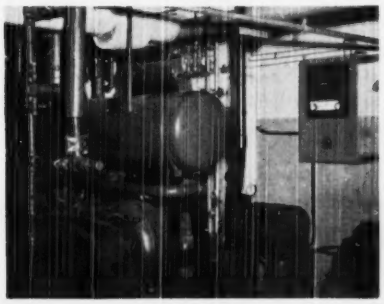
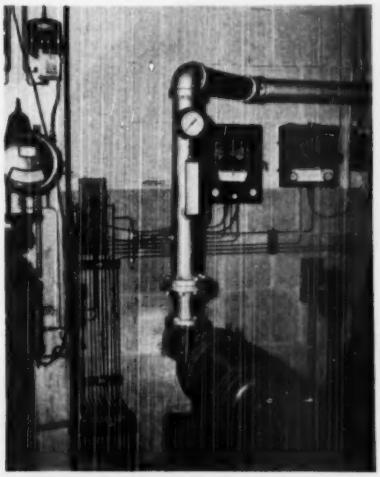
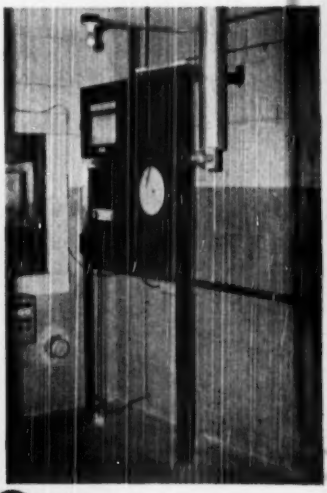


POWERS

Controlling, Indicating and Recording Instruments Regulating Air Conditioning in Smaller Test Rooms.







EN YOU WANT ACCURATE AIR CONDITIONING CONTROL

Call in a Powers Engineer. He may be able to help you get the best control for your requirements.

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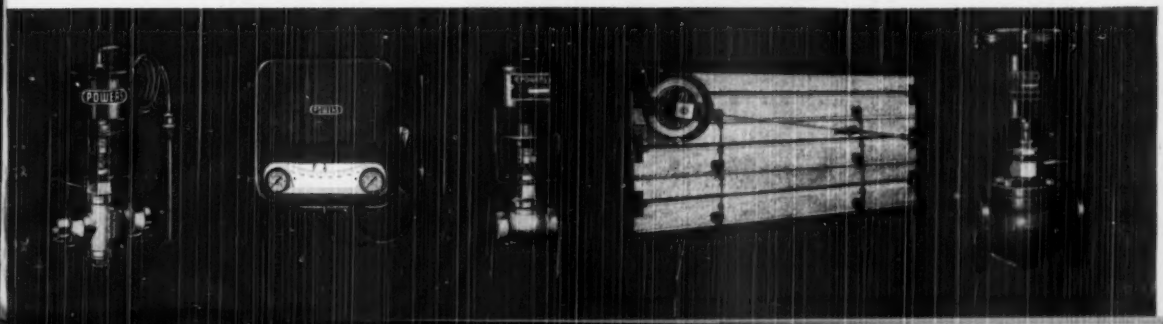
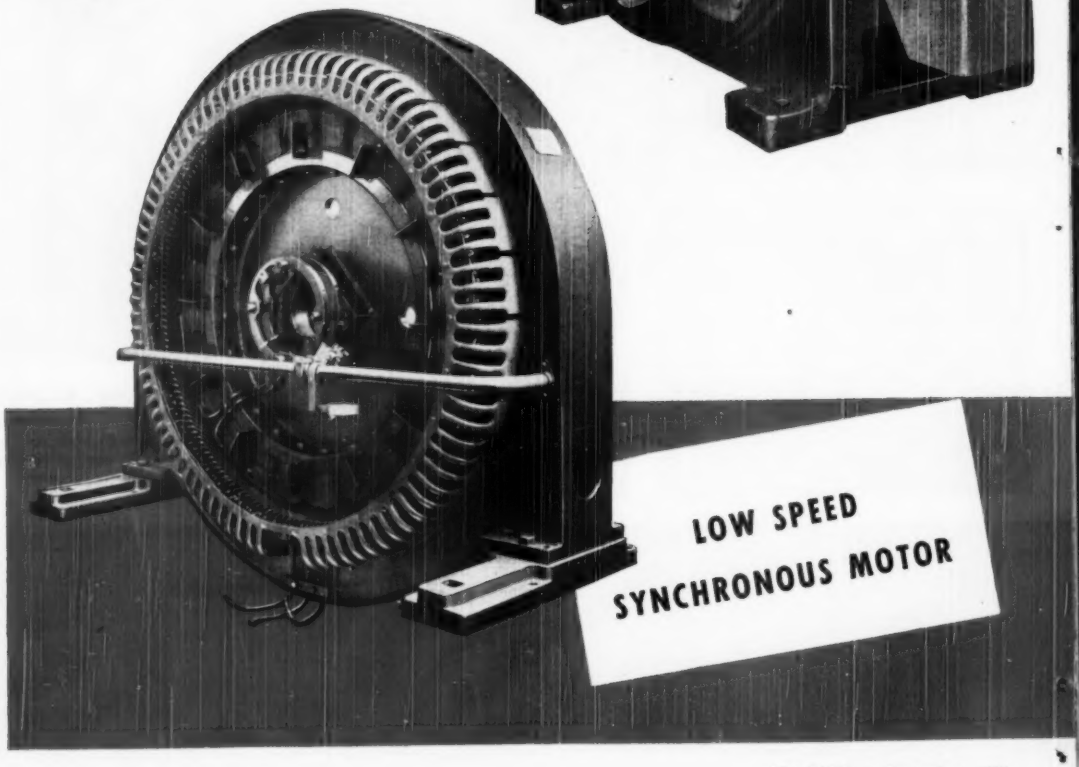


SAVE ON POWER BILLS



WITH GENERAL ELECTRIC SYNCHRONOUS MOTORS

SYNCHRONOUS MOTORS IMPROVE POWER FACTOR

1. **Save you penalty charges for poor power factor**

2. **Save money by releasing needed generating capacity by reducing demand and**

Here's an example:

One company improved power factor from 72 to 84 per cent by installing a 300 hp .8 leading power factor G-E synchronous motor in place of another motor. This corrected power factor released 260 kva capacity in their generating equipment and allowed installation of additional motors.

These savings in cost of operation are available to you.

Savings in the initial cost of equipment are also available—when synchronous motors are used in their natural fields of application. To find out about these natural fields of application, get in touch with our nearest office.

REMEMBER—General Electric Synchronous motors—whenever you need constant speed. They can give you lower initial cost, lower operating cost. For bulletin information, fill in the coupon:

G-E SYNCHRONOUS MOTOR CONTROL INCREASES YOUR SAVINGS

G-E synchronous control provides the accurate adjustments that enable you to improve power factor. Here's where details count—where the slightest variation of a pointer on a meter means money saved—or lost. And General Electric has not overlooked these elements. Consider the meters for a moment. Here, G-E has devised a long scale with the pointer in the same plane as the figures so there can be no possibility of misreading the instrument. Anti-glare glass is used so no distortion is possible.

The new smaller rheostat, too, has design features that not only result in longer life but in greater operating convenience and accuracy. The handle has been molded to fit the fingers of the operator—to prevent slippage and over correction. You can be sure, too, that the new field circuit will respond instantly to rheostat adjustment.

Protection is assured the operator through the attractive steel enclosure. The cabinet resists blows, keeps out dirt and other operating hazards. All live parts are strongly guarded. Plant appearance is improved with this control designed to line up with other G-E power units such as switchgear. Ask your nearest G-E office for more information about this equipment that safeguards your investment . . . helps save operating expenses.

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Gentlemen:

Please send me: ☐ GEA-5332, Low-speed Synchronous Motors; ☐ GEA-5426, High-speed Synchronous Motors; ☐ GEC-505, Synchronous Motor Control.

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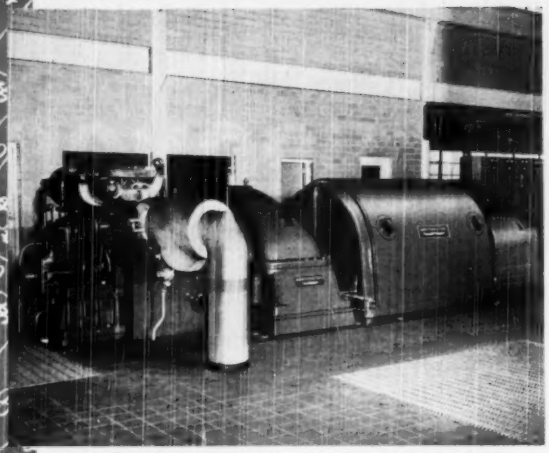
FACTS ABOUT THE *Most Profitable Turbine Generator Investment* YOU CAN MAKE...



One of two Worthington 4000 kw turbine generator sets installed in a mid-western municipal power plant, operating on 600 #G and 750 F.T.T. Steam exhausting to 28" Hg vacuum.

Worthington's Experience and Undivided Responsibility Assure Low Cost, Dependable Power

Builders of steam turbines for over 30 years, Worthington's Steam Turbine Division is backed by the experience and resources of the entire Worthington organization — recognized leaders in the power plant field for more than a century. In view of today's increased turbine pressures and temperatures — and the resulting needs for new and special materials — this vast, combined source of technical knowledge has proved of tremendous practical value in developing turbine design, construction and performance.

Generators Are Worthington's, Too

The generators used with Worthington Turbines are built by a Worthington subsidiary that has specialized in this field for over 45 years. This means that Worthington, as manufacturers of *complete* turbine generator units, assumes *undivided responsibility* for the coordinated design, assembly and performance of these units.

Before shipment, Worthington Turbines and Generators are assembled together *as units* for testing and adjustment — eliminating the necessity for doing this after installation. Also, for installation and service, Worthington turbine specialists and regular Worthington service men are always available from our District Offices throughout the country.

Check These Over!

Adding up, Worthington's matchless power plant experience . . . huge manufacturing facilities . . . long specialization in both turbine and generator manufacture . . . undivided unit responsibility . . . and skilled technical service . . . are the best assurance you can get anywhere of efficient, economical steam turbine power.

Worthington makes turbines in a wide range of sizes and types, each one designed to make steam do more work. For details proving *there's more worth in Worthington*, contact your nearest Worthington representative. Or write to *Worthington Pump and Machinery Corp., Steam Turbine Division, Wellsville, N. Y.*

WORTHINGTON

STEAM TURBINES

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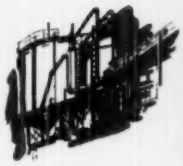
A GREAT TEAM IN STEAM

PERMUTIT PRODUCTS for POWER PLANTS

ZEO-KARB SOFTENER. The Permutit Zeo-Karb® Softener removes both hardness and bicarbonates from raw water. The effluent is soft and reduced in total solids and alkalinity. Sulphate-carbonate ratio may be adjusted as desired by a system of mixed effluents.

SILICA REMOVAL PLUS DEMINERALIZATION. Demineralization by cold ion exchange processes produces water of comparable quality to distilled water at a fraction of the cost of distillation. Treatment by an anion exchange resin, Permutit S®, reduces silica to less than 0.2 ppm.

DEAERATING HEATER. The Permutit Deaerating Heater, utilizing exhaust or bled steam, prevents corrosion of feed lines, stage heaters, economizers, and boilers by removing oxygen and free CO_2. Capacities from 12,000 to 1,400,000 pounds per hour are in service.



SLUDGE BLANKET HOT LIME SODA. The application of the sludge blanket design to hot lime soda treatment gives you soft water of a low silica content. **HOT ZEOLITE.** Subsequent treatment by Permutit Q® yields a final zero-hardness effluent.

PRECIPITATOR. The Permutit Precipitator is used to lower alkalinity, reduce hardness, and help to remove turbidity. It can also be used to reduce silica.

These basic processes–plus Permutit skill–can solve your water conditioning problem

Whatever your water treatment problem, Permutit offers all types of equipment and minerals that can supply soft, clear, chemically correct water for your plant. Write for full information to The Permutit Company, Dept. P-9,330 West 42nd Street, New York 18, N. Y., or to Permutit Company of Canada, Ltd., Montreal.

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WATER CONDITIONING HEADQUARTERS FOR OVER 37 YEARS

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FUEL-AIR RATIO
FUEL FEED OVER-FIRE DRAFT

GET ALL *Three* AND HAVE THESE RESULTS

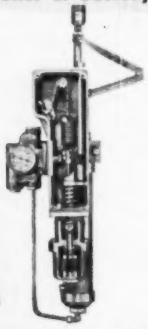
1 More steam from your present boiler.

2 Less fuel — coal — oil — gas required.

3 Savings in maintenance whether you have a single boiler or battery of boilers.

WHETHER YOU HAVE ONE OR A BATTERY OF BOILERS . . . . INSTALL

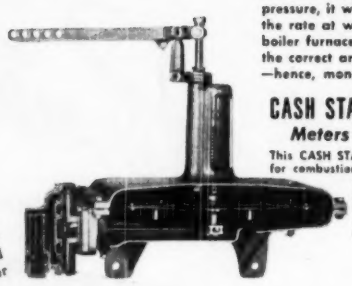
CASH STANDARD
AUTOMATIC COMBUSTION CONTROL SYSTEMS



CASH STANDARD FUEL FEED CONTROLLER • • •

Automatically Regulates Fuel Feed

This CASH STANDARD Master Controller automatically regulates fuel feed. Locate it conveniently. Working from boiler pressure, it will adjust the rate of combustion by regulating the rate at which fuel (any kind of fuel) is supplied to the boiler furnace. And it will adjust the Air Flow Controller so the correct amount of air is supplied for proper combustion —hence, money saving.



CASH STANDARD AIR FLOW CONTROLLER • • •

Meters the Air Needed for Combustion

This CASH STANDARD Air Flow Controller meters the air needed for combustion. Install it near its damper. It is not affected by changes in fuel bed resistance or any other variables, because it meters air supply according to the differential pressure through the gas passages of the boiler, doing its part to insure perfect combustion.

Bulletin No. 300
Shows Applications
. . . Tells How the System
Works in Your Favor

Tells about Correct fuel feed —Correct fuel-air ratio— Correct over-fire draft and how you get all three. It shows applications and how various CASH STANDARD Units can be made to meet any specific condition and work on any boiler or stoker with any kind of fuel.

•

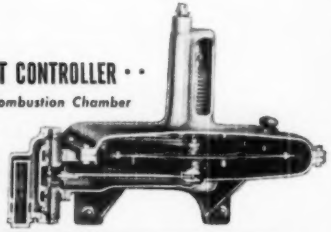
Send for it

•

CASH STANDARD FURNACE DRAFT CONTROLLER • •

Maintains a Constant Draft in the Combustion Chamber

This CASH STANDARD Furnace Draft Controller (which comes complete with Operating Power Cylinder) works from overfire draft, regulating the boiler uptake damper to maintain a constant draft in the combustion chamber.



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DECATUR, ILLINOIS

CASH STANDARD
CONTROLS . . VALVES

Best Buy in Variable Speed!

COMPARE THESE FEATURES of *Vari-Pitch* Automatic sheave with any other variable speed drive and see why *Vari-Pitch* Automatic drive gives you more for your drive dollar.

1. Changes speeds with one hand while machine is running.
2. All mechanism is inside one sheave actuated by movement of the motor base.
3. Ample capacity and safety factor of multiple belts.
4. Full range of sizes from 1 to 40 hp.
5. Top speed is 100% higher than low speed.
6. Quiet operation.
7. Cushioned start.
8. Simple design and easy installation make cost low
9. Occupies no more space than ordinary sheave.

Vari-Pitch Automatic drive will pay for itself very quickly in increased production, improved quality and more flexible operation on many machines in your plant. Ask your Allis-Chalmers Authorized Dealer or Sales Office representative to give you savings and cost figures on your operations. Or write for bulletin 20B7223.

ALLIS-CHALMERS, 952A SO. 70 ST. MILWAUKEE, WIS.

Vari-Pitch and *Texrope* are Allis-Chalmers trademarks. A-3063

ALLIS-CHALMERS

Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

MOTORS — ½ to 25,000 hp and up. All types.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

PUMPS — Integral motor and coupled types from ¾ in. to 72 in. discharge and up.

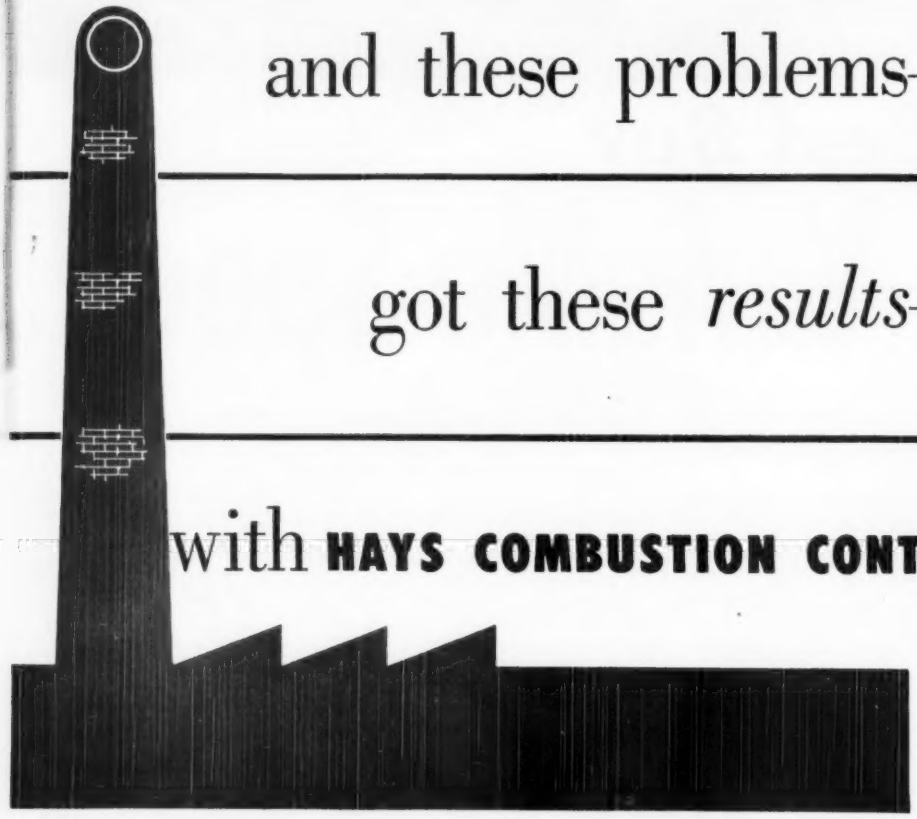
these leading companies →

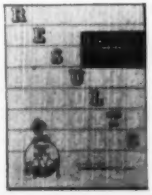
with these conditions {

and these problems →

got these *results* →

with **HAYS COMBUSTION CONTROL**



	AMERICAN TOBACCO COMPANY	SHERWIN-WILLIAMS COMPANY	RAYBESTOS-MANHATTAN COMPANY	BEMIS BROS. BAG COMPANY	SUNSHINE BISCUIT COMPANY
no. of boilers	Three (one stand-by)	Three	Four	Two	One, plus steam generator incinerator
rating	16,500 lb per hr	65,000 lb per hr	19,650 lb per hr	70,000 lb per hr and 80,000 lb per hr	31,500 lb per hr
load	Varies from 40-50,000 lb per hr total fluctuation up to 20,000 lb per hr	75,000 max. each boiler	120,000 lb per hr in winter—70,000 lb per hr in summer	68,000 lb per hr in winter, 60,000 lb per hr in summer. Daily variation 15,000 lb per hr	From 10,000 to 30,000 lb per hr
fuel	Coal	Coal	Coal	Oil and coal	Oil
use of steam	Power and process	Process and space heating	Mostly for process, also for pumps, compressors and heating	Power, process and heating	Process
	1. To recondition or add new boiler 2. Better process load regulation	Combustion efficiency	To get better efficiency. To get more out of boilers due to rising load	Accurate control of pulverized coal and oil firing through wide load swings	To lower costs. Drastic load fluctuations
	(1) "The Hays instruments and controls, through greater efficiency . . . gave us the solution . . . that of increasing steam capacity" and (2) "regulating the steam that goes into process."	"Operating efficiency has been as high as 82%—much of the credit going to the accuracy of (Hays) automatically controlled combustion."	"Our basic reason for installing the Hays control was to obtain better efficiencies. Our aim was more than reached . . . efficiency . . . 79.3%."	"We have made test runs using the Hays automatic combustion control system, bringing the load rapidly up from 8,000 lb per hr to 80,000 lb per hr with excellent results."	"Our management and operating crew are well pleased with the new (Hays) unit, not only because of the low maintenance costs but also because the equipment enables us to keep close watch over our operating costs."
					

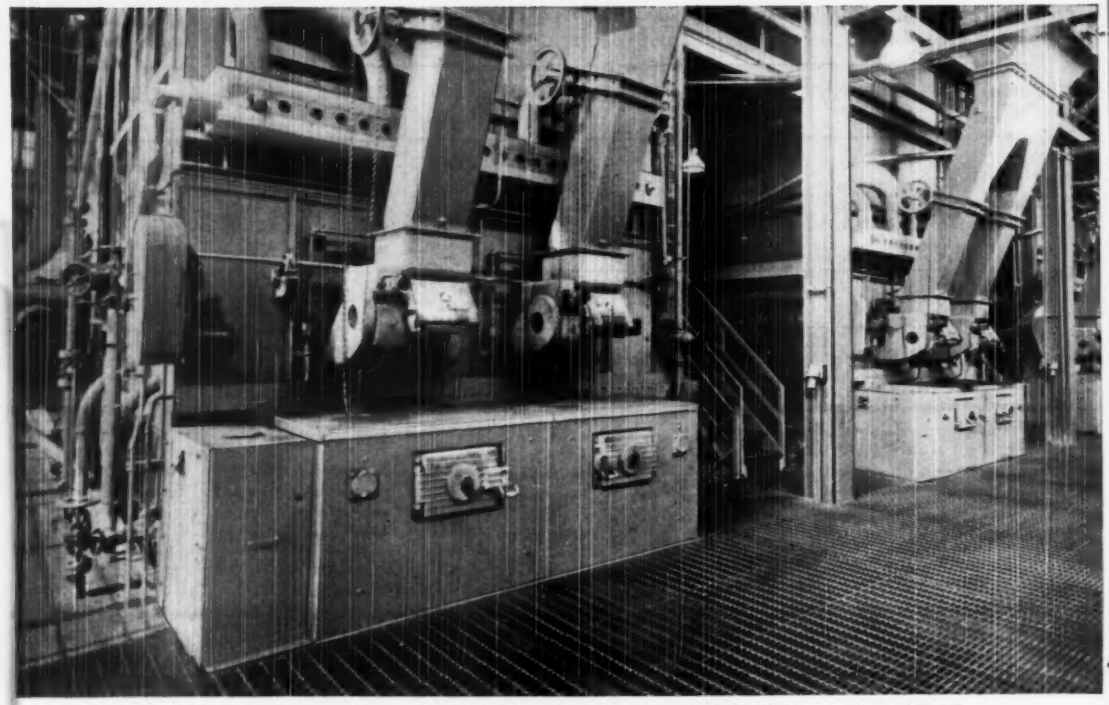
compare your control requirements and write for the results story which matches your needs—free on request

THE **HAYS** CORPORATION *MICHIGAN CITY 3, INDIANA* • Automatic Combustion Control • Boiler Panels •

Hays-Penn Flowmeters • Veriflow Meters and Veritrol • Gas Analyzers • Draft Gages • Combustion Test Sets • CO_2 Recorders • Electronic Oxygen Recorders

YOU'LL SAVE MONEY WITH A SPREADER

YOU'LL SAVE EVEN MORE WITH A . . .



Three 9' x 15'3" traveling grate Perfect Spread Stokers installed under Erie City Bent Tube boilers deliver a maximum of 55,000 lbs. per hour at a well-known chemical plant in Missouri. Sverdrup & Parcel, Inc., St. Louis, were the Consulting Engineers.

Only Perfect Spread Stoker assures even coal distribution . . . won't clog on wet coal . . . has a cinder return system that works . . . adjustable overfire air

THERE'S NO GUESSWORK about it. You'll save real money – important sums regularly – with a spreader stoker. It enables you to burn a wide range of coals, including the cheaper, high ash coals, with top efficiency. No more paying premiums for coal when you have a spreader stoker. You utilize the coals that are attractively priced in your locality.

IN SPREADER STOKERS—IT'S PERFECT SPREAD —FOR MOST STEAM AT LEAST COST

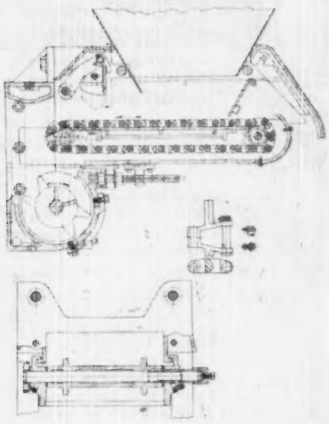
Exclusive features, unique in design, make the Perfect Spread Stoker the most efficient spreader that has ever been built. First and foremost, its feeder assures positive, continuous and accurate coal feed . . . it won't clog even when coal is wet. Next, the spiral overthrow rotor is unmatched for *even* coal distribution. And the engineered cinder reinjection and adjustable overfire air system are final assurance of superior fuel combustion.

Perfect Spread Stokers are made in both continuous discharge, dumping and stationary grate types. Coal feed is adjustable from 50 lbs. to 7,500 lbs. of coal an hour per feeder. Capacities range from 8,000 to 500,000 lbs. of steam per hour. Mail coupon on next page for full information . . . and be sure to call in your Consulting Engineer for recommendations regarding your requirements.

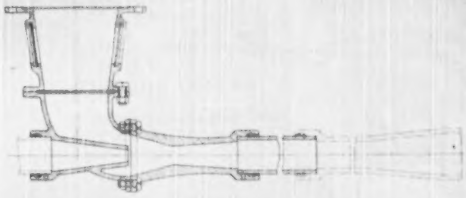
STOKER *BUT* . . . .

PERFECT SPREAD STOKER

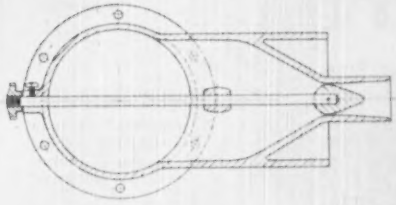
AMERICAN ENGINEERING COMPANY



NON-CLOGGING CONVEYOR FEEDER: Coal enters feeder from hopper, and is conveyed positively, continuously and uniformly forward. Coal is not fed in slugs.



ENGINEERED CINDER REINJECTION SYSTEM: An extremely efficient system; all fittings of alloy iron. Air driven through the venturi section sucks cinders into the air stream for return to the furnace. A *separate* line is provided for each cinder drain point.

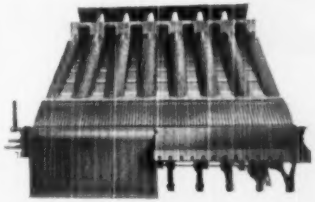


ADJUSTABLE OVERFIRE AIR SYSTEM: Most of the overfire air enters furnace through nozzles in side or rear walls. Each nozzle is a separate venturi-type unit and *individually* adjustable.

WHERE UNDERFEED STOKERS ARE INDICATED YOU CAN'T BEAT THE TAYLOR STOKER

Taylor Underfeed Stokers of adequate grate area deliver over 90% of the ash to the ashpit . . . and most of the remainder is collected in boiler passes without expensive dust recovery equipment.

Shown at right is a 7-Retort, 25 Tuyere Taylor Stoker. It provides low-cost steam for plants of moderate size. The principles of combustion are identical with those of the high capacity Taylor Stokers that are the standard for central stations and large industrial plants.



AE

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PHILADELPHIA 25, PENNA.

Other AE Products are Marine Deck Auxiliaries, Hele-Shaw and Hydramite Fluid Power, Lo-Hed Hoists, Car Shakers, Car Pullers.

American Engineering Company
2400 Aramingo Ave., Philadelphia 25, Pa.

Gentlemen: We are interested in "most steam at least cost." Send me full information about ____ Perfect Spread Stokers; ____ Taylor Stokers.

Name _____ Title _____

Company _____

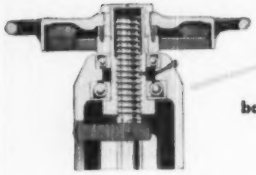
Address _____

City _____ Zone _____ State _____

You get all these features in

THESE WERE EDWARD FIRSTS!

IMPACTOR* HANDWHEEL
Maximum closing torque in minimum space. An all time high in valve design.



EVALTHRUST* YOKE BUSHING
Patented ball bearing construction for easy valve operation.

CLOSURE INDICATORS
No guessing if valve is tightly closed for either regular operation or for special tests.

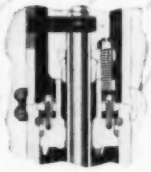
LOW PRESSURE-LOSS BODY CONTOURS
Both globe and angle bodies let maximum flow through. Pioneered by Edward. Copied but never bettered.

THREE-POINT GUIDING
Streamlined, cored out guide ribs, integral with body, keeps disk in alignment. Dangerous stem guiding eliminated.

SELF-CENTERING DISK THROTTLING LIP
Avoids jamming or cocking, assures tight seating, prevents wire-drawing.

FREE FLOATING TUBULAR DISK-PISTON
Quicker opening, surer closing, flow tested for less pressure loss.

EQUALIZER
Original design. Gives higher, surer piston lift, lowers pressure loss, eliminates wear-producing vibration.



EDWARD PRESSURE-SEAL DESIGN
First pressure-seal non-return valves were built by Edward. Pressure-sealing parts do not guide floating disk-piston, insuring a permanent seal.

INTEX* INTEGRAL SEATS
Hard facing applied directly to valve body completely eliminates possibility of leaks behind screwed or welded-in seat rings.

These are also Edward Firsts!

Evalized* plating of valve parts for wear and corrosion resistance . . . Patented welded-bonnet Univalves* . . . Impactor* handles for small valves . . . Seat located guide ribs in gate valves . . . No-bonnet instrument valve construction . . . Intex* Stellited welded-in seats . . . Hour-glass type disk-piston . . . EValpak* packing . . . Separated feedline stop-check valves . . . Screwed and welded flanges for forged steel valves . . . Swing bolt retaining washer construction, and

***Patented Interchangeability of Stop, Check and Non-Return Valves . . .* Greatest possible valve flexibility for your plant!**

*Registered trade names of Edward Valves, Inc.

Edward Non-Return Valves

DON'T SETTLE FOR LESS!

No valve is more important in your boiler plant than your non-return valve.

From it, you expect quick, sure operation in an emergency. Low pressure loss is important, too.

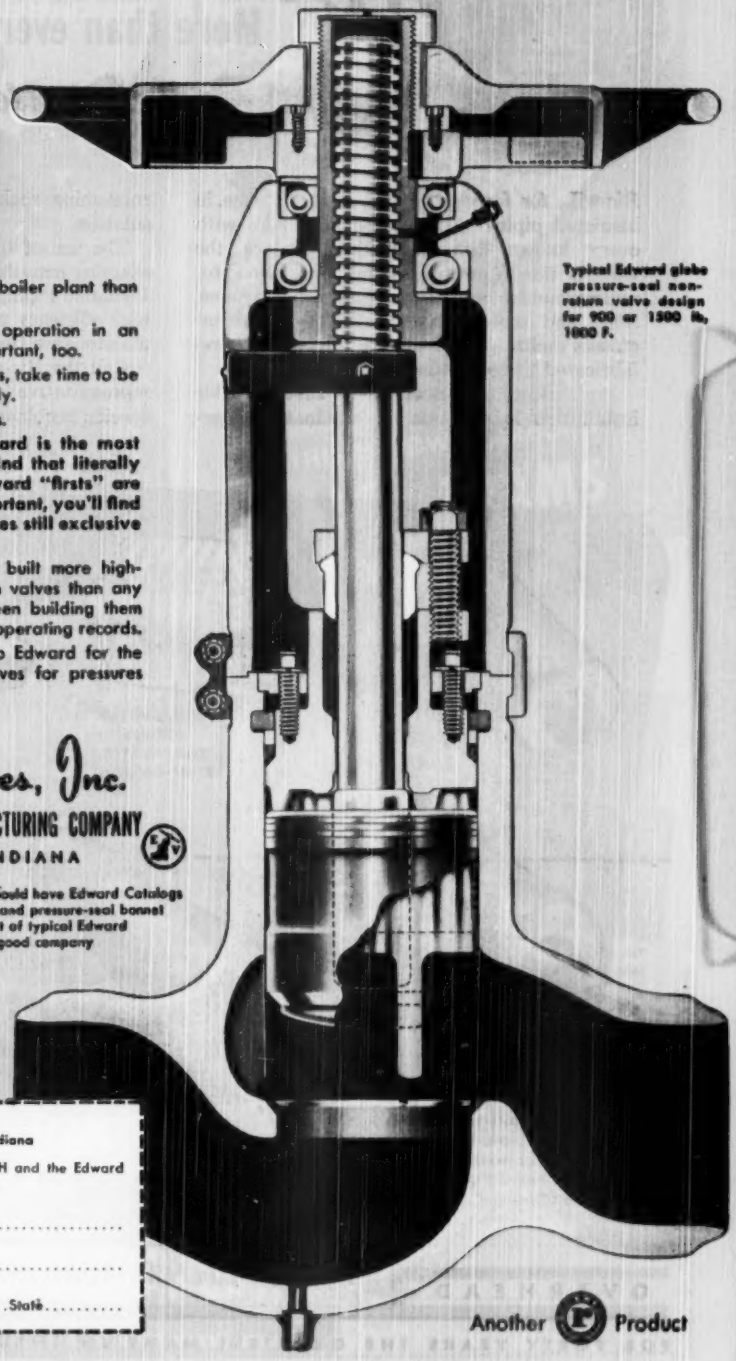
Next time you buy non-return valves, take time to be sure. Go into design features carefully.

Also, look at actual service records.

If you do, you'll find that Edward is the most copied valve in the field. You'll find that literally dozens of features that were Edward "firsts" are now industry standards. More important, you'll find there are still many patented features still exclusive with Edward.

You'll also find that Edward has built more high-pressure high-temperature non-return valves than any other manufacturer . . . and has been building them for more years, piling up unmatched operating records.

Don't discount experience. Look to Edward for the best and the first in non-return valves for pressures from 150 to 2500 lb sp.



Typical Edward globe pressure-seal non-return valve design for 900 or 1500 lb, 1000 F.

Edward Valves, Inc.

Subsidiary of **ROCKWELL MANUFACTURING COMPANY**

EAST CHICAGO, INDIANA

ASK FOR THESE CATALOGS • You should have Edward Catalogs 12-B and 12-H, covering non-return valves and pressure-seal bonnet valves in your file. Also, we'll send you a list of typical Edward non-return valve installations to show what good company you'll be keeping if you specify Edward.

Edward Valves, Inc.
1220 West 144th Street, East Chicago, Indiana

Please send me Catalogs 12-B and 12-H and the Edward non-return valve installation list.

Name .....

Street .....

City ..... Zone .... State .....

Another Product

RIC-WIL 40th YEAR DEPENDABLE INSULATED PIPING SYSTEMS 1910 · 1950

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More than ever before you'll want

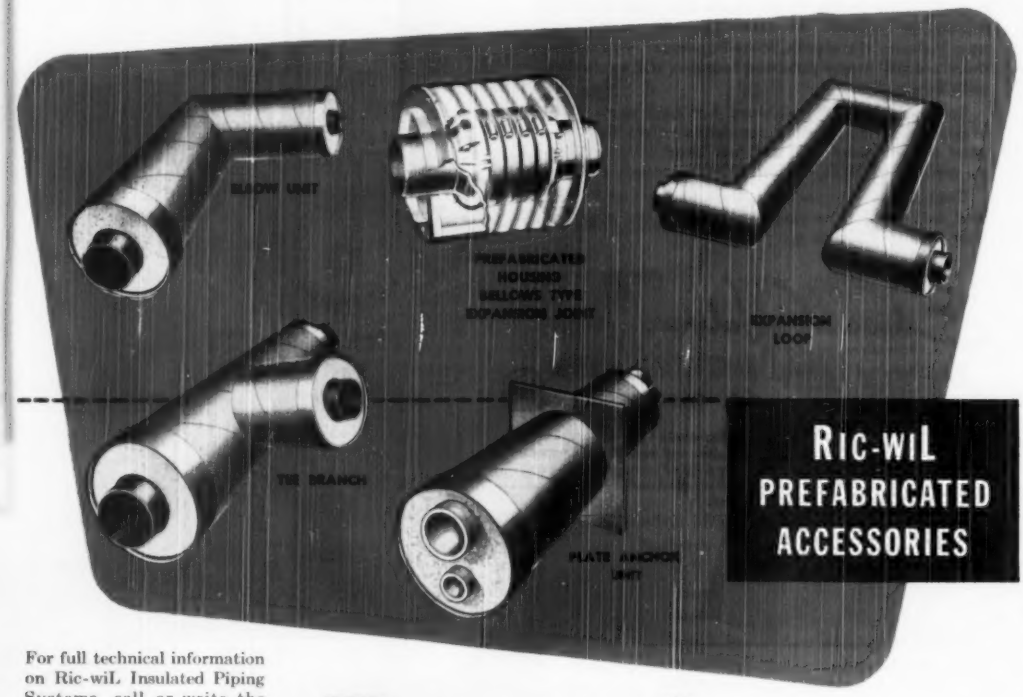
RIC-WIL *Prefabricated* Insulated Piping

Ric-wiL, for forty years the greatest name in insulated piping systems, has kept pace with every known development to produce the world's finest protection and insulation for underground or outside overhead piping systems. Alert and cost-conscious contractors and engineers realize the advantages of Ric-wiL prefabricated 21-foot "straight-run" sections.

Prefabricated accessory units save valuable installation labor costs by eliminating time-consuming makeshift field application of insulation.

The use of the finest known materials, and exacting manufacturing standards give Ric-wiL Insulated Piping Systems "built-in" features for high efficiency performance and extremely long maintenance-free life.

Call the Ric-wiL office nearest you and our representative will be glad to discuss your specific problems at your convenience.

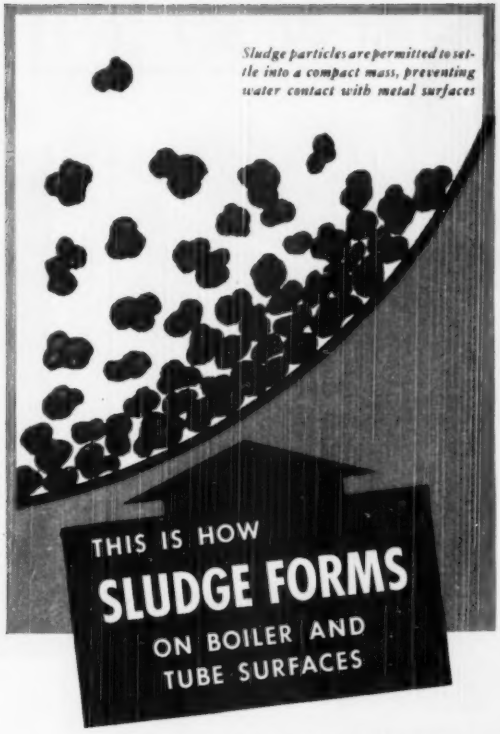


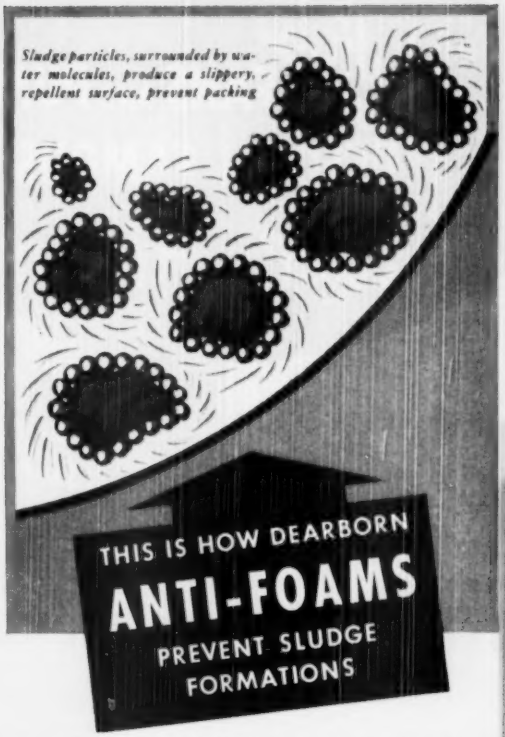
RIC-WIL PREFABRICATED ACCESSORIES

For full technical information on Ric-wiL Insulated Piping Systems, call or write the Ric-wiL office nearest you or Dept. 5-R in Cleveland, Ohio.

RIC-WIL
INSULATED PIPING SYSTEMS
THE RIC-WIL COMPANY · CLEVELAND, O.
OVERHEAD UNDERGROUND

FOR FORTY YEARS THE GREATEST NAME IN INSULATED PIPING SYSTEMS


Sludge particles are permitted to settle into a compact mass, preventing water contact with metal surfaces
THIS IS HOW
SLUDGE FORMS
ON BOILER AND
TUBE SURFACES


Sludge particles, surrounded by water molecules, produce a slippery, repellent surface, prevent packing
THIS IS HOW DEARBORN
ANTI-FOAMS
PREVENT SLUDGE
FORMATIONS

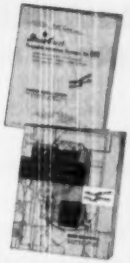
DEARBORN POLYAMIDE ANTI-FOAMS KEEP SOLIDS IN SUSPENSION—PREVENT SLUDGE FORMATIONS

Dearborn Polyamide Anti-Foam No. 659 performs four important functions in boiler water treatment.

1. It makes it easier to maintain a fluid type sludge in boiler water. It prevents growth of the sludge crystals and does not permit them to become attached to the heating surfaces.
2. Anti-Foam No. 659 has protective colloid action which controls the precipitation of carbonate scale. It also prevents "after precipitation" where lime soda water is used for make-up.
3. As an Anti-Foam treatment, No. 659 reduces the number of small bubbles responsible for foaming conditions. Instead, it produces a relatively small number of large bubbles which break harmlessly on the surface.
4. Anti-Foam No. 659 prevents corrosion in feed lines, heaters and internal boiler surfaces caused by dissolved oxygen.

Consult your Dearborn representative for assistance in selecting the boiler water treatment best suited to your needs.

DEARBORN CHEMICAL COMPANY
310 S. Michigan Ave. • Chicago 4, Ill.



TWO VALUABLE BOOKLETS
Write for copies

For information on Dearborn Polyamide Anti-Foams, write for Bulletin No. 5008.

For a complete description of Dearborn Industrial Water Treatment and Engineering Service, write for Bulletin No. 5000. The coupon is for your convenience.

Dearborn Chemical Company
Dept. PO, 310 South Michigan Ave.,
Chicago 4, Ill.

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Name.....

Company.....

Position.....

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City.....State.....

Dearborn
TRADE MARK REGISTERED
THE LEADER IN WATER TREATMENT AND RUST PREVENTIVES

"Buffalo" FANS AND PUMPS USED IN FAMOUS Caribe Hilton

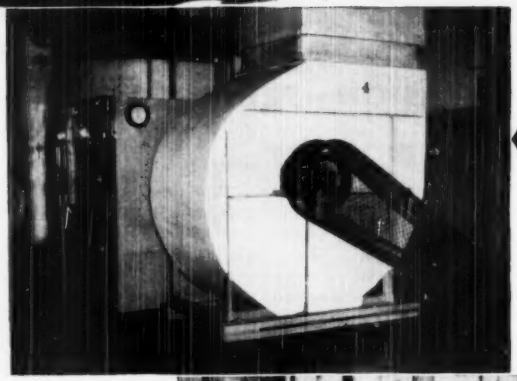
CARIBE HILTON HOTEL, built by Puerto Rico Industrial Development Company; Carrier Corp., General Air Conditioning Contractors.

SPECIFY THIS "BUFFALO" EQUIPMENT FOR BEST RESULTS IN *Your* BUILDING!

Caribe Hilton, ultra-modern ten-story hotel in San Juan, Puerto Rico, is the latest triumph of the Hilton group.

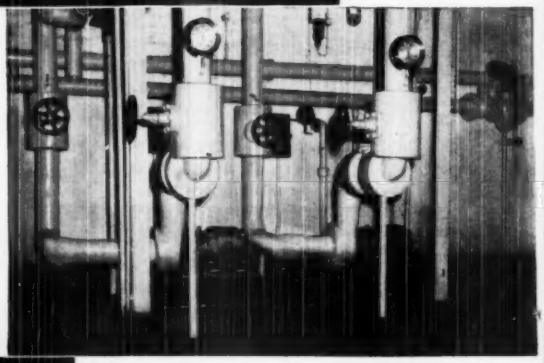
It is no coincidence that many of this hemisphere's leading public buildings and plants are served by "Buffalo" Fans and Pumps. Other users of "Buffalo" equipment are the Terrace Plaza and the Shamrock. The "Buffalo" reputation for long life and efficiency on the job goes back seventy-two years. Many "Buffalo" Ventilating Fans are still performing well after fifty or more years, while "Buffalo" Pumps are setting similar endurance records.

Be sure of the air handling and liquid handling service in YOUR building plans — specify "Buffalo".



"BUFFALO" LIMIT-LOAD FAN, popular for large-scale ventilation or air conditioning.

"BUFFALO" CLOSE COUPLED PUMPS are widely used on air conditioning service.



"Buffalo"

BUFFALO FORGE COMPANY
488 Broadway Buffalo, New York
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.
Branch Offices in all Principal Cities

FIRST FOR PUMPS AND FANS

11 of the 16 largest turbine-generators*

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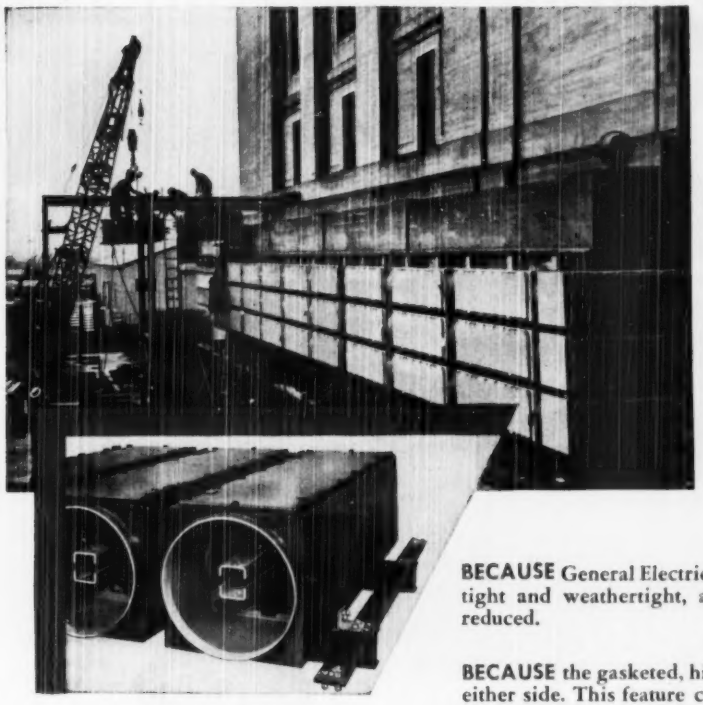
GENERAL ELECTRIC ISOLATED PHASE BUS RUNS



RATINGS
15 and 23 kv
1200 to 7000 amperes

BECAUSE General Electric isolated-phase bus runs are dust-tight and weathertight, and maintenance costs are thus reduced.

BECAUSE the gasketed, hinged covers can be opened from either side. This feature cuts inspection time and costs by allowing access to the interior of the run from the most convenient position. Cover lugs release the cover without removal of bolts. The cover is swung open on either one of two sets of hinges.

BECAUSE you receive G-E isolated-phase bus runs completely assembled as a three-phase package, including running ground bus. They are installed in a short time at lower predictable costs.

BECAUSE you have one source of responsibility when you order from General Electric—complete co-ordination between planning, engineering, manufacturing, and service facilities to give maximum savings efficiency to the customer.

Your G-E Sales Representative has complete information about isolated-phase bus runs. Ask him for a copy of GEA-5460, a 28-page publication that will aid you in planning your bus runs, or write to *Apparatus Department, General Electric Company, Schenectady 5, New York.*

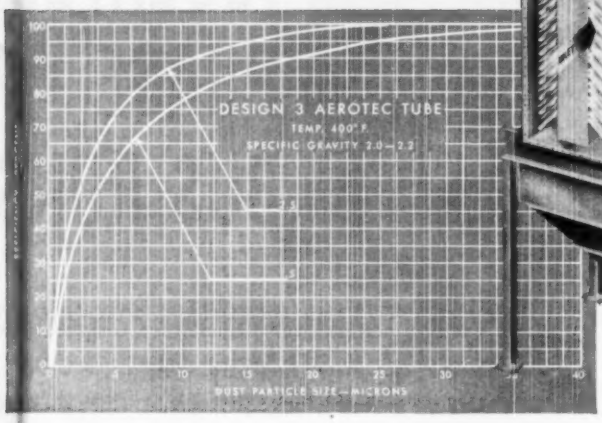
*Installed and planned, rated 6000 amperes and over.

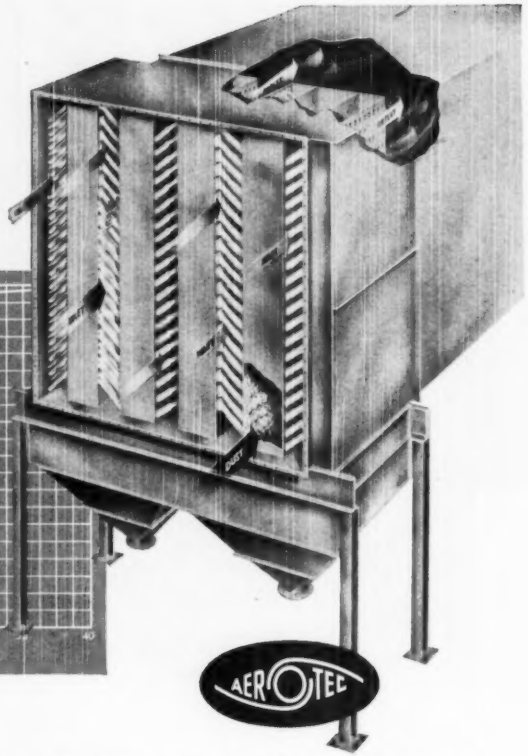
GENERAL ELECTRIC

855-24

ON *Full* OR *Partial* LOADS

AEROTEC DUST COLLECTOR EFFICIENCY *is still high*





Keeping efficiency high on a fluctuating boiler load is important in meeting dust ordinances. The Aerotec Design 3RAS Collector has solved this problem by the use of small diameter tubes.

It will be seen from the curve that 2.5 w.g., efficiency on 20 micron particles, at full load, is 98%. Reducing the load to 0.5 w.g., equivalent to half load, the Aerotec Collector still provides an efficiency of 91.5%, ample to meet most dust ordinance requirements encountered.

These small diameter tubes also provide a compact unit that will fit into almost any space requirement, a factor that is extremely important when the installation is made in an existing power plant where space is usually at a premium.

Project and Sales Engineers

THE THERMIX CORPORATION

Greenwich, Conn.

(*Offices in 28 Principal Cities*)

Canadian Affiliates: **T. C. CHOWN, Ltd.,** *1440 St. Catherine St., W., Montreal 25, Quebec*

THE AEROTEC CORPORATION

GREENWICH, CONN.

FORCED BOILER OUTAGES TURBINE SANDBLASTING, ELIMINATED!

BEFORE Allis-Chalmers Silica Removal Service	**AFTER** Allis-Chalmers Boiler Feedwater Service Installed
57 Boiler shutdowns in 33 months with 834 boiler hours of unscheduled outage.	Boilers and turbines operate 14 months between scheduled cleanings!
133 Tubes replaced. 29 Tubes welded.	*No* boiler tube failures!
Turbines sandblasted every 4 months.	*No* turbine sandblasting!
Power Production down 50% before each cleaning.	Rated power capacity is maintained!

ACTUAL CASE!

SILICA REDUCTION IN BOILER FEEDWATER with Allis-Chalmers chemicals and treatment produced these startling power plant economies at the Southern Advance Bag & Paper company, Hodge, Louisiana.

One of the leading manufacturers of paper bags in the south, this company has a daily steam production average of 9,350,000 lbs from 10 boilers serving 5 turbines generating 12,000 kw, a number of turbine-driven auxiliaries, and turbines operating paper machines.

Raw water analyses taken over a period of three years at Southern Advance show a silica reduction of 94% due to the use of Allis-Chalmers chemicals.

You can get similar results from A-C water conditioning service, chemicals and equipment.

Whatever your industry — paper, petroleum, food, steel — you'll get prompt, convincing results with Allis-Chalmers water conditioning service. An expert representative is available, ready to recommend proper chemicals or help select the right process for your power plant requirements.

Get in touch with him today at your Allis-Chalmers Office for complete information.

JOHN B. DAVIS, with 15 years experience in power plant water conditioning, is one of the A-C specialists located around the country to advise you of correct water conditioning equipment, chemicals and service.

ALLIS-CHALMERS

Water Conditioning

✓ EQUIPMENT ✓ CHEMICALS ✓ SERVICE

ALLIS-CHALMERS, 952A SO. 70 ST. MILWAUKEE, WIS.

Gentlemen:
Please send me specific information on A-C chemicals for feedwater treatment.

Name

Title

Company

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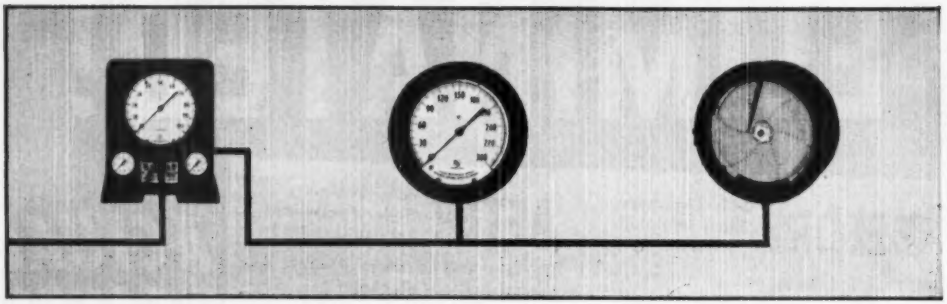
ASHCROFT and MICROSEN TRANSMISSION SYSTEMS

Score New Advance in the Field of Remote Indication

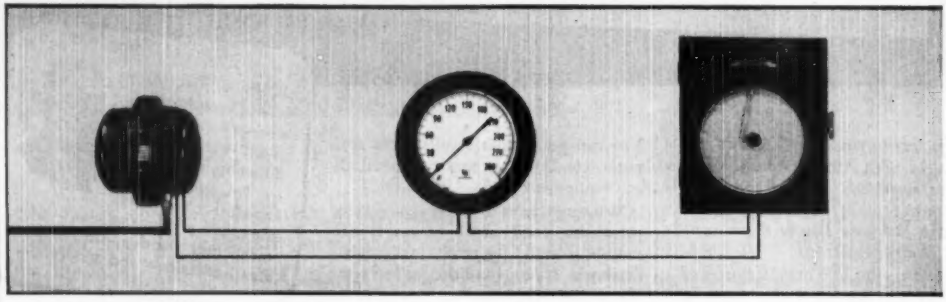
ASHCROFT PNEUMATIC AND MICROSEN ELECTRIC PRESSURE AND TEMPERATURE TRANSMISSION SYSTEMS COMBINE . . . SIMPLICITY, EASE OF INSTALLATION AND MAINTENANCE . . . LOW COST . . . AND HIGH OVERALL ACCURACY



ASHCROFT PNEUMATIC PRESSURE TRANSMISSION SYSTEMS

Particularly suitable where it is desired to avoid expensive, high-pressure piping or to confine inflammable, hazardous or corrosive liquids and gases close to their source. Pressure indications are transmitted by means of low pressure air over distances up to 1000 feet. Installation costs, leakage and maintenance problems, inherent with high pressure lines, are eliminated. These systems measure pressures up to 50,000 psi, including compound or straight vacuum ranges. There is an extensive selection of Bourdon tube materials and protective devices for all conditions of service.

Temperature Transmission—In addition to pressure measurement, the Ashcroft system can be used to measure temperature in applications where a thermostatic element would be more applicable than thermocouple actuation. Information about these systems available upon request.



MICROSEN ELECTRIC AND ELECTRO-PNEUMATIC TRANSMISSION SYSTEMS . . . PRESSURE OR TEMPERATURE

These systems . . . the Microsen Electric Pressure, the Microsen Electric Temperature and the Microsen Electro-Pneumatic Temperature . . . are designed to provide a wide range of remote pressure or temperature indication.

Microsen Electric Pressure Transmission Systems (illustrated above), are ideal wherever process pressures should be remotely indicated over distances of more than 1,000 feet, where an instantaneous response is desired for operational control, or where electrical instrumentation predominates.

Microsen Electric Temperature Transmission Systems transmit temperature indications wherever process temperatures should be indicated at one or more points some distance from the temperature source.

Microsen Electro-Pneumatic Temperature Transmission Systems provide the most accurate, easily maintained means of converting electrical temperature indications at a remote point into low pressure, pneumatic signals for temperature indicating, recording and control.

THE VERSATILITY OF MICROSEN TRANSMITTERS

Beyond the transmission of pressures and temperatures, these instruments can be used for transmitting, amplifying or relaying a wide variety of electrical measurements. Typical fields of application available upon request.

A PRODUCT OF

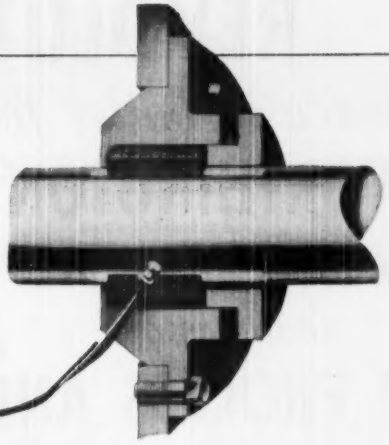
MANNING, MAXWELL & MOORE, INC.

STRATFORD, CONNECTICUT

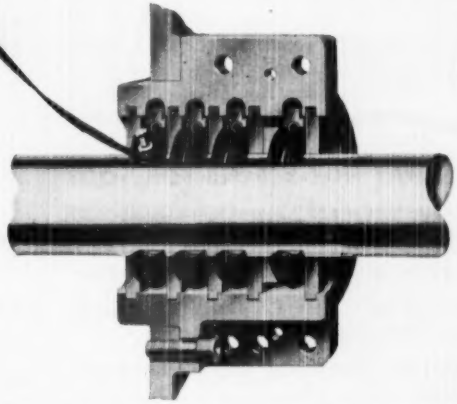
Makers of 'Ashcroft' Gauges, 'Hancock' Valves, 'Consolidated' Safety and Relief Valves, 'American' Industrial and 'Microsen' Electrical Instruments. Builders of 'Shaw-Box' Cranes, 'Budgit' and 'Lead Lifter' Hoists and other lifting specialties

COPPUS TURBINES

offer you a choice of packing rings



STANDARD METALLIC RING PACKING — Made of high grade asbestos cores encased in specially treated lubricated aluminum foil. Recommended as a low-friction, long-service packing for steam temperatures up to 850 F and back pressures up to 50 lb. Adjustable packing glands keep leakage at minimum. Easy access to packing rings.



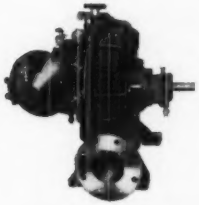
OPTIONAL CARBON RING PACKING — Consists of three carbon packing rings on the pressure side and one beyond the leak-off section. Each ring has three segments held together by a stainless steel garter spring. For back pressures up to 75 lb. Standard for vacuum or gas operation, or when leak-off is desired.

Heavy chrome plating on shaft at stuffing box is common to both types of Coppus packing.

Coppus Turbines ranging from 150 hp down to fractional in 6 frame sizes

FIT TURBINE COSTS TO HORSEPOWER NEEDS

When you buy turbines rated close to your exact horsepower needs, you save plenty of money. That's because turbines are generally priced in proportion to their size. The wide range of sizes of Coppus Turbines promises purchasing economy for you from the 150 hp size down to the smallest. As for operating and maintenance economies, you get them, too, from such other features as: greater number of manually operated valves for individual control of steam nozzles; replaceable cartridge-type bearing housings and others. For complete details . . .



WRITE FOR BULLETIN 135
COPPUS ENGINEERING CORPORATION
169 Park Avenue
Worcester 2, Mass.
Sales offices in THOMAS' REGISTER

COPPUS "BLUE RIBBON" TURBINES

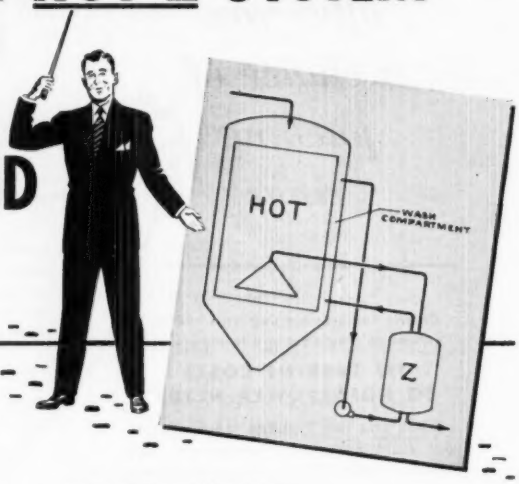
REVOLUTIONARY

advance in boiler feed water treatment!

WORTHINGTON HOT-Z SYSTEM

combines all the best features of

HOT PROCESS AND ZEOLITE



Choosing between Hot Process and Zeolite is no longer a boiler feed water problem. The Worthington Hot-Z System gives you the advantages of each system including deaeration.

SEE WHAT HOT-Z DOES FOR YOU:

1. Reduces hardness to 0.2 ppm without addition of excess soda alkalinity.
2. Operates on cheapest chemicals — lime and salt.
3. Saves enough in chemical costs to pay for average installation in 3 years.
4. Offers easy control when operating on variable waters.
5. Removes oxygen to 0.005 cc per litre.
6. Makes cumbersome two-tank lime-soda-phosphate systems obsolete.
7. Includes ideal facilities for the necessary hot *clear water zeolite washing process.*
8. Makes filters unnecessary except in special cases.
9. Does away with vent condenser scale.
10. Reduces phosphate precipitates in boiler to unobjectionable amount.
11. Reduces silica.

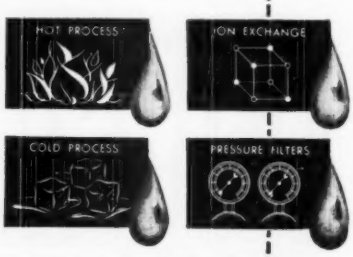
INVESTIGATE! If you are now considering split treatment, hold up your decision until you examine the Worthington Hot-Z System. Tell us your conditions of service and get our recommendation in terms of dollars and benefits. You'll find in our Hot-Z System, as in so much other equipment, *there's more worth in Worthington. Worthington Pump and Machinery Corporation, Water Treating Division, Dunellen, N. J.*

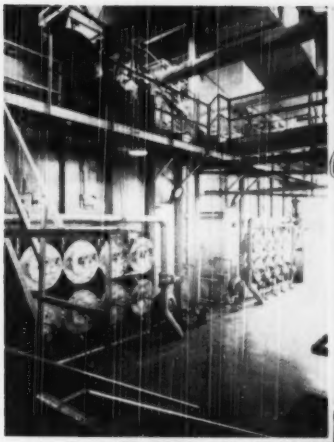
10-2

WORTHINGTON

WATER CONDITIONING

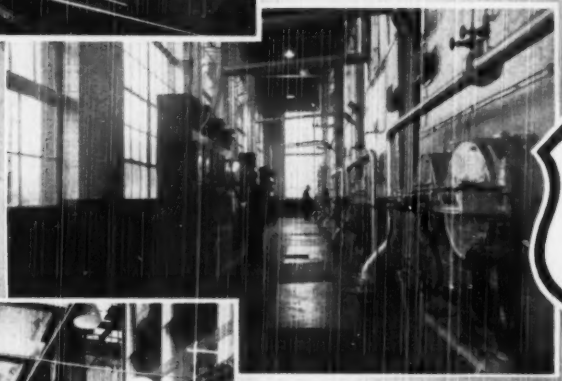
Worthington Makes More of the Equipment for All Types of Water Conditioning Systems





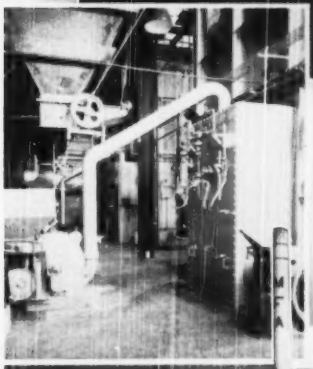
10 UNION
Steam Generators at
Producers Creamery Co.

• SPRINGFIELD • MONETT • LEBANON
• ELDORADO SPRINGS, MO.



1st Choice for 16 Years

1934–2 Union "L" Type 265 HP Springfield
1940–1 Union "L" Type 265 HP Springfield
1945–1 Union "H" Type 533 HP Springfield
1946–2 Union "H" Type 603 HP Monett
1946–2 Union "H" Type 323 HP Lebanon
1946–2 Union "H" Type 323 HP Eldorado Springs



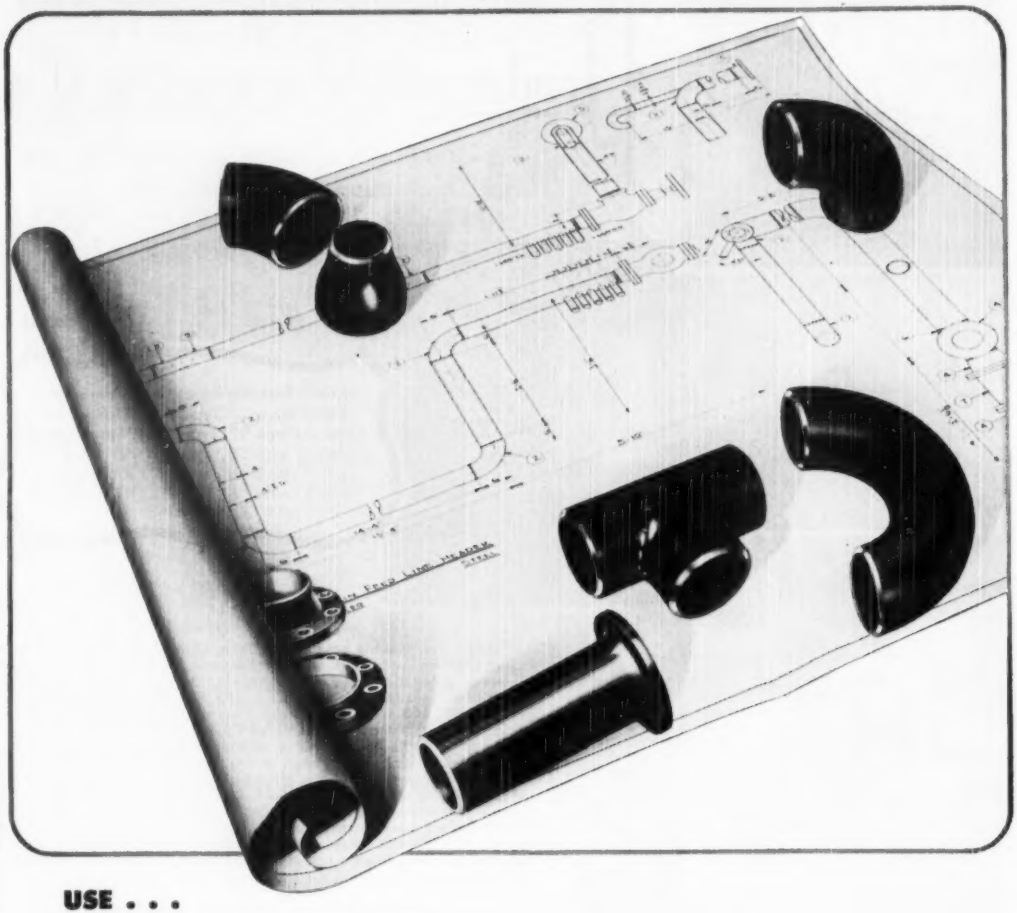
HERE is a running account of Union Boiler installations in 4 milk plants of Producers Creamery Company, Springfield, Mo.—an area believed to be the heaviest milk producer in the United States. Producers in 1928 at Springfield, Mo. handled only 100,000 pounds of milk per day for 1000 farmer patrons. Today, they operate milk plants at Springfield, Monett, Lebanon and Eldorado Springs, Mo. with a combined capacity of 2,150,000 pounds of milk daily for some 10,000 patrons. An official of this company says "Having had experience with the two Union Boilers installed in the Springfield plant in 1934, we purchased eight more of them for Springfield and the three new plants. This should give anyone a pretty good idea of our opinion of Union Boilers." Union Boilers, once introduced, are "practical Economists" on any cost sheet. Consult with Union engineers before you select steam generating equipment. More than a half century of boiler design and construction will go to work for you.

UNION IRON WORKS . . . *Since 1890*

373 CASCADE STREET • ERIE, PENNA.

BOILERS • PROCESS EQUIPMENT • FABRICATED STEEL

TO DO A BETTER PIPING JOB . . .



USE . . .

GLOBE PRECISION PROCESS SEAMLESS WELDING FITTINGS

When you specify and use Globe Welding Fittings you have the product of an organization with unusually broad metallurgical experience. Globe's precision-process method of production reaches back to the manufacture of the Globe seamless tubes themselves which are the "raw material" of Globe welding fitting fabrication.

GLOBE STEEL TUBES CO., Milwaukee 4, Wisconsin

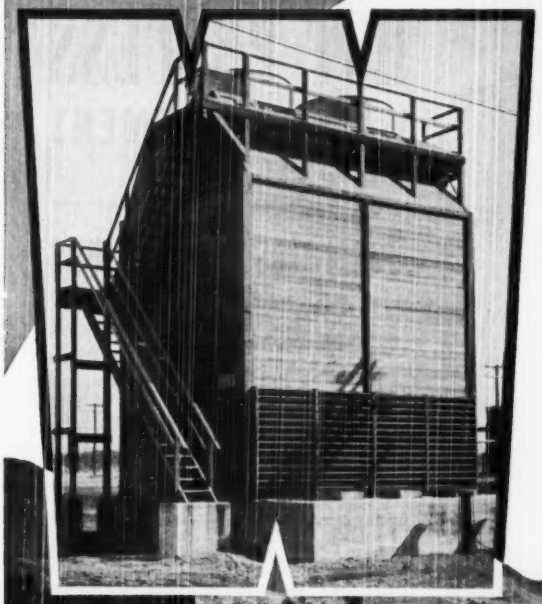
Chicago • Minneapolis • Cleveland • Detroit • New York • Philadelphia
St. Louis • Tulsa • Houston • Denver • San Francisco • Glendale, Cal.

Producers of Globe seamless stainless steel tubes — Gloweld welded stainless steel tubes — carbon — alloy — seamless steel tubes — Globeiron seamless high purity ingot iron tubes — Globe Welding Fittings.

Send for the Globe Welding Fittings Catalog—and look to Globe as a preferred source of supply.

WATER'S TOO SCARCE and COSTLY to WASTE

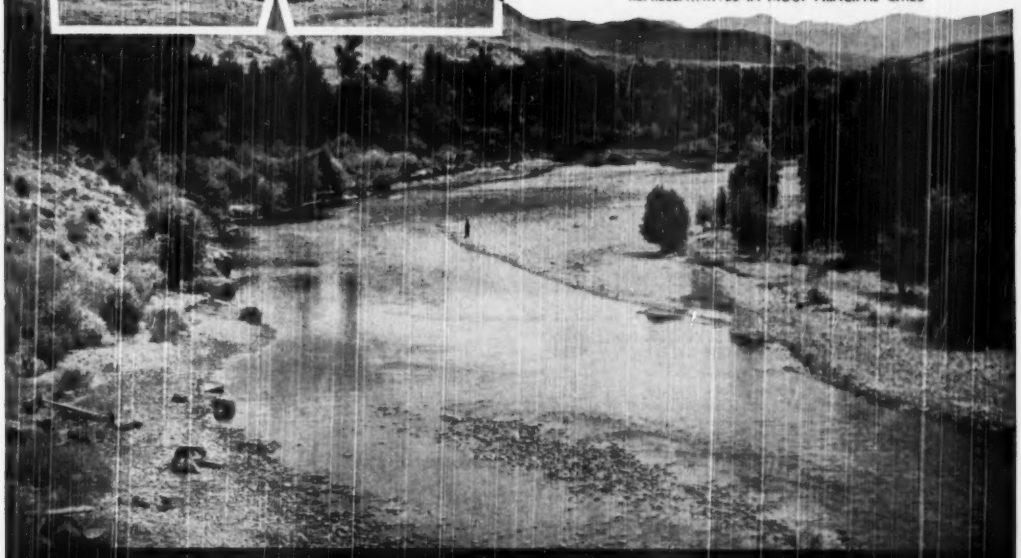
Save it with a C. H. W. Cooling Tower



Look how much this source of water has dried up! And this is no exception, either. More and more plants are feeling the "pinch" in water supply. Industrial expansion, plus higher domestic use, has overtaxed supply in many areas. Good surface water sources are low and, in areas where there is plenty, the quality is poor and costly to make usable. Although sufficient underground water deposits exist,* it will be several years before they can be tapped. All this means that you'll have to get the most out of what you have, or face production cuts or even a shutdown. But there is something you can do—use a C. H. W. cooling tower for operations requiring cooled water, thus permitting use of the same water over and over again. And you'll find that a C. H. W. cooling tower will not only save water and its cost, but also that cooling performance is guaranteed. For any operation requiring cooled water—chemical, processing, petroleum, air conditioning, etc.—check on a C. H. W. cooling tower first. Write for literature.

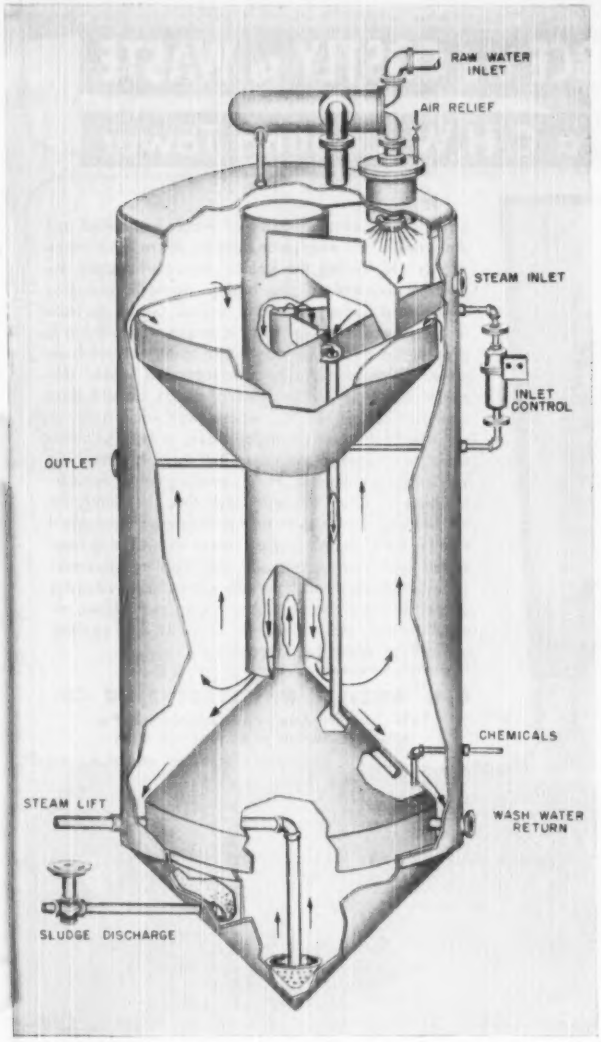
*According to Government surveys

C. H. WHEELER MANUFACTURING CO.
1800 Sedgley Ave., Philadelphia 32, Pa.
REPRESENTATIVES IN MOST PRINCIPAL CITIES



C. H. Wheeler
SINCE 1903

DECK MACHINERY · STEAM CONDENSERS
STEAM JET AIR EJECTORS
OF PHILADELPHIA



New
HOT PROCESS
WATER TREATMENT

☆

Deaerates and Softens Simultaneously!

FOR the first time, INFILCO has combined within a single, compact unit, features the power plant operator has long wanted! The new Deaerating Hot Process ACCELATOR® features a *steam lift* which produces internal slurry recirculation without mechanical devices. The same steam lift efficiently deaerates the water undergoing treatment, thereby eliminating separate deaerating mechanisms. Silica is reduced to a new low, because the Hot Process ACCELATOR provides for prolonged slurry contact as well as the redissolving of the magnesium in the slurry, which is later reprecipitated. This brings a saving in chemicals.

A storage compartment is provided in the upper part of the Deaerating Hot Process ACCELATOR for softened and deaerated water, to handle momentary peak demands. This new and better treatment process provides . . 1. Self-contained deaeration, 2. Controlled slurry recirculation, 3. Maximum silica removal by the redissolving of magnesium, 4. Reprecipitation for chemical economy, 5. An effluent low in turbidity, alkalinity and hardness. Investigate the new Deaerating Hot Process ACCELATOR. Write for complete information today!

FREE LABORATORY SERVICE . . SEND FOR THIS WATER CONDITIONING ANALYSIS SHEET!

Make sure your water meets the exacting specifications you require. Send for our Water Analysis Sheet, then fill in and return it with a sample. You will receive our laboratory analysis and report promptly. A valuable INFILCO CHEMICAL CALCULATOR slide rule sent FREE to all who return our analysis sheet properly completed. *No cost or obligation is involved for this laboratory service.*

INFILCO
• BETTER WATER CONDITIONING AND WASTE TREATMENT SINCE 1894

INFILCO INC.

GENERAL OFFICES: 325 WEST 25th PLACE • CHICAGO 16, ILLINOIS
SALES OFFICES IN TWENTY SIX PRINCIPAL CITIES

WORLD'S LEADING MANUFACTURERS OF WATER CONDITIONING AND WASTE TREATING EQUIPMENT

POWER

SEPTEMBER 1950 · VOL 94 · NO. 9

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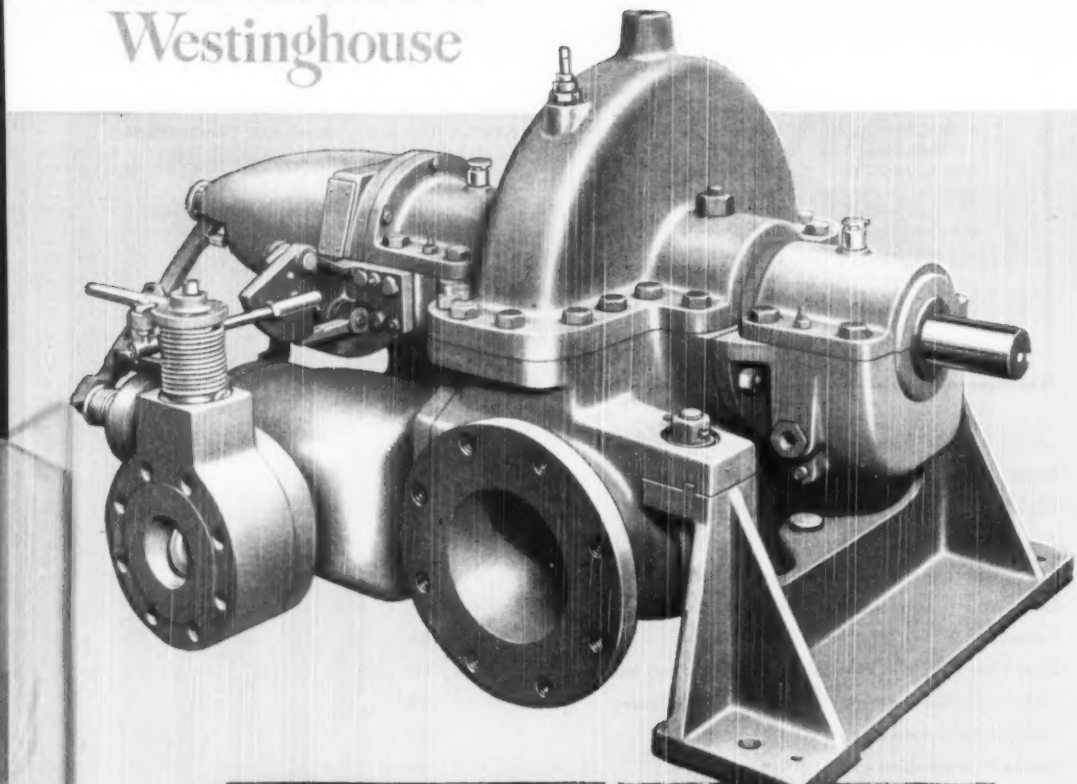
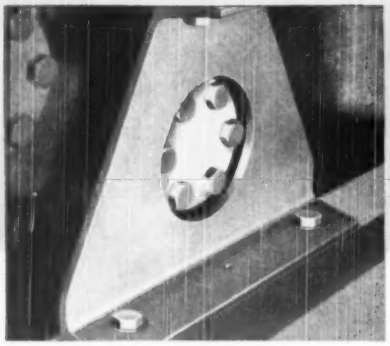
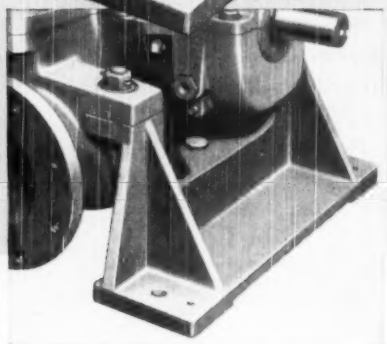
YOU CAN BE **SURE**.. IF IT'S
Westinghouse





Centerline support at governor end



Centerline support at exhaust end, including vertical kingpin

3-WAY CENTERLINE SUPPORT

The Type E method of support allows three-way freedom of expansion and contraction without disturbing the alignment of the rotor shaft. The governor end is mounted on a strong but flexible channel beam to permit axial expansion. At the shaft-coupling end, a unique keyed support connects to the turbine near the shaft centerline to permit lateral expansion; and a vertical kingpin transmits thrust from the expanding steam pipes directly to the foundation and not to the turbine. Thus, the casing is left free to move vertically with expansion or contraction.

Alignment that "STAYS TRUE" when the heat's on!

Heat expansion can't disturb Type E alignment. The operation of driven equipment is easier, more dependable—installation costs are reduced. Westinghouse unique *three-way centerline support* keeps alignment perfect with the driven machine. Strong supports at both the governor and exhaust ends are supplemented by a vertical kingpin that transmits lateral thrust to the foundation. Hot or cold—for constant operation or instant standby power, you can depend on the Type E turbine to "Stay True"!

Centerline support is just one of the many unusual maintenance-saving features built into the Type E turbine. It's built to give long, economical service—to operate reliably and efficiently when the going is tough. Dual protection against overspeed, weatherproof bearing seals, corrosion-resisting gland zones, floating movement of governing and trip linkage, and parts interchangeability between wheel sizes are just a few of the cost-saving advantages included in the new Type E drives.

Compare—then you'll share the trouble-free service enjoyed by many users of Westinghouse Type E turbines. For the full story, call your nearby Westinghouse Steam Specialist. Ask for the Type E Turbine Book B-3896, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-30516

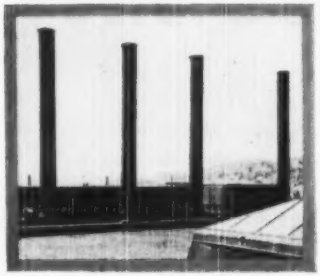
Westinghouse *TYPE E* Turbines

TAKE A PAGE FROM EXPERIENCE

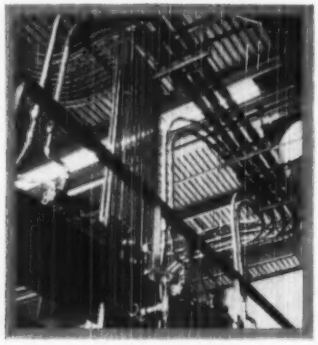
use BYERS WROUGHT IRON

TO REDUCE MAINTENANCE

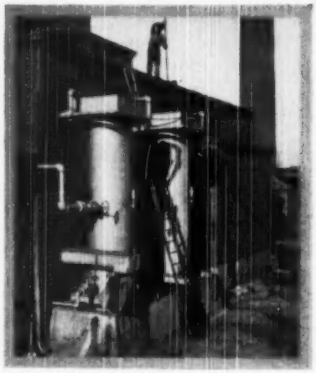
Mounting costs are prodding everyone into finding ways of reducing maintenance expense . . . which means getting longer life from every installation. You'll find some helpful hints on how to do it right on this page. In each application, Byers Wrought Iron combats severe corrosion, aids in eliminating the trouble and expense of premature failures and excessive repairs.



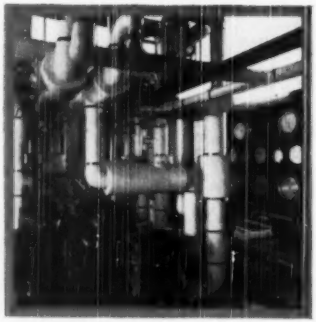
Aggressive acids, formed by sulfur and carbon compounds dissolved in moisture, threaten the life of every unlined metal stack. Wrought iron has proved its superior resistance hundreds of times; users have reported doubled and tripled service from wrought iron. It's a life extender for coal and ash handling equipment, too.



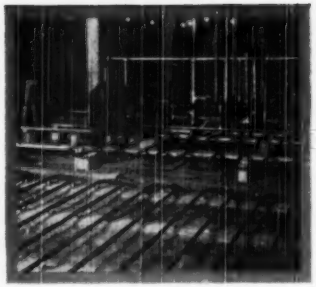
When the fluids handled or the surrounding atmospheres are corrosive, process piping can be a maintenance headache. In dozens of applications, wrought iron helps keep lines serving longer.



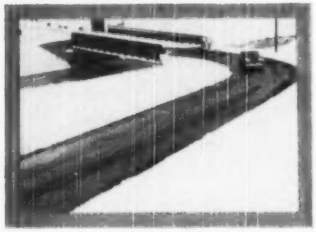
Frequent replacements of tubing in condensers and heat exchangers are avoided, if proper materials are used. In one study of a number of condensers, wrought iron average service life was more than twice that of ordinary materials.



Condensate, blow-down, feed and underground distribution lines . . . Byers Wrought Iron has been successfully used in all these services, to combat corrosion and cut down on repairs. We'll be glad to cite records on any application.



Radiant heating, utilizing pipe coils of Byers Wrought Iron pipe embedded in the concrete floor, is the newest thing in modern plants. Floors are comfortable, warmth is concentrated in living areas, torrid and frigid zones are eliminated, and discomfort of drafts and frequent air changes is minimized. Wrought iron for coils is the first choice of designers.



A snow melting system using Byers Wrought Iron pipe installed under the traffic surface cleared the snow from this driveway serving a large industrial plant. Similar systems are successfully serving in loading platforms, sidewalks, and service areas. Wrought iron has the necessary qualities to stand the severe conditions involved.

Wrought iron's unusual resistance to corrosion comes from its structure and composition, which are duplicated by no other material. Bulletins are available on all applications shown; ask for copies dealing with your particular interest.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, San Francisco. Export Division: New York, N. Y.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

BYERS

GENUINE WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

POWER

PHILIP SWAIN, EDITOR • SEPTEMBER 1950 • ESTABLISHED IN 1882

Batten Down the Hatches!

WHEN THE BAROMETER fell and the wind rose, sea-wise sailing-ship masters sang out the warning cry, "Batten down the hatches." In the minds of most of us it's come to sum up the many steps taken to make a ship ready for strains and stresses ahead—shortened sail, extra rigging and cargo lashings, manned pumps, a spare hand on the wheel.

It's a good watchword for us today. Like the ship's master, we don't know what kind of a blow to expect, what strains we'll have to endure. But we do know our nation and our industry is entering a period of stress. It's time to put our plants and their crews in fighting trim, ready for anything the winds may bring. Here are some points to check:

Bigger Loads. Demand on central stations and industrial power plants is sure to grow as we swing into accelerated production for Korea and after. The first brunt of this must be borne by existing plants. A blueprint doesn't make steam or kilowatt hours. Is your plant ready?

Take a look around now, while you've still got time. Look for weak links that may pull down the output of the entire plant—an inadequate draft system that cuts boiler capacity, poor generator cooling that keeps you from getting full rating, etc. Usually a small change will make the difference, quickly and with modest expenditure of materials and money. Now, when the needed equipment is still readily available, is the time to do something about it.

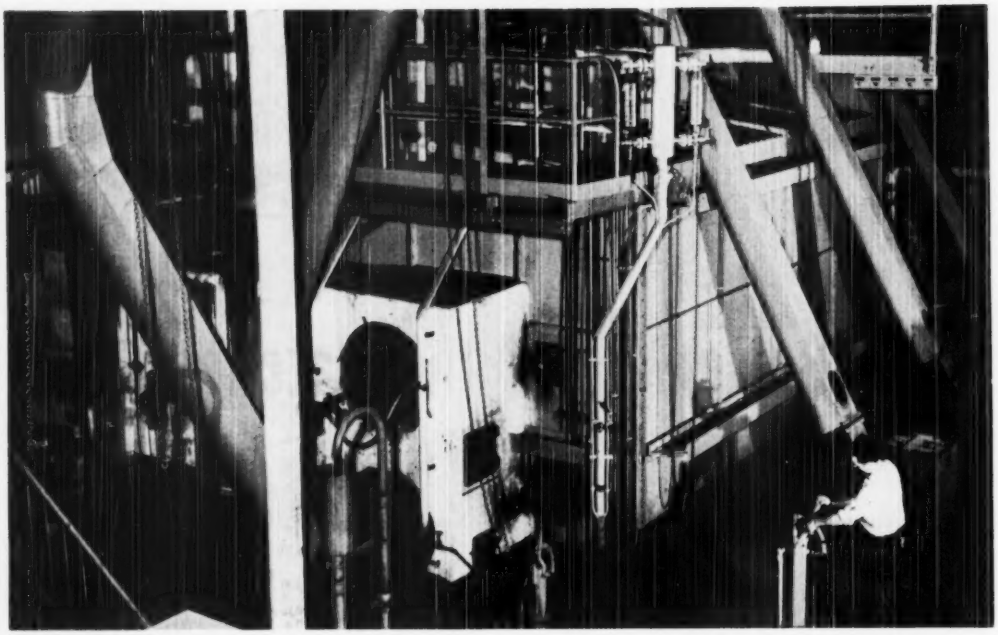
Manpower. Unemployment is at a relatively low level. There just isn't the manpower reservoir to meet big expansions in war production and absorb losses to the armed forces. You're going to lose some men, have a tough time finding replacements.

Start now to figure how you can swing the job with fewer men. Plan the training that will fit inexperienced men to step into more responsible jobs when the inevitable losses occur.

Fuels. Right now, and for the immediate future, you should be able to get the fuel you need. It's a sure bet though, if the crisis widens and deepens, that fuel supplies will get tight. As a result of the past war, and unsettled conditions since, many plants are ready to burn more than one type of fuel. In the times ahead, such fuel versatility will pay even bigger dividends. If you're not geared to switch fuels, get going while the job can be done without the headaches of an emergency conversion.

And when it comes to fuels, don't forget that here's one case where "hoarding" is both wise and patriotic. When fuels are readily available, stock them against the future. This irons out seasonal differences in production, relieves the producers' storage problem, cuts the peak load on transportation facilities and gives you mighty good insurance against spot shortages that may develop.

These are just a few general, but practical, suggestions. You know your own situation better than anyone else. If to this knowledge you add a full and sure realization that emergencies will certainly arise as we move farther down the road to a war economy, you'll come up with a concrete program for "battening down the hatches" in your own plant. Remember, there's nothing tougher than shortening sail after the gale's hit.



STEAM FROM WASTE WOOD: These two boilers, rated 100,000 lb per hr at 600 psi, 725 F, burn hog fuel in dutch-oven cells. Third unit, of same size, is designed for oil fuel only. It's used when wood fuel is not available, and for standby service

Solve Slagging Problems to Burn

High-pressure high-temperature steam plant replaces old one that had 18 boilers and 22 power units. Layout of this Canadian plant emphasizes efficient burning of pulp-mill salt-contaminated wood waste using combustion air preheated to 580 F

► STEAM AND POWER are major ingredients of pulp and paper, and the higher the quality of the product the greater the amount per ton. So an organization like British Columbia Pulp and Paper Co, which zealously guards its reputation for highest quality pulp, must be equally vigilant with respect to power-service equipment and costs. At their Woodfibre Mill they recently met increasing use of power per ton of pulp by replacing old equipment with modern units in keeping with the mill's high production standards.

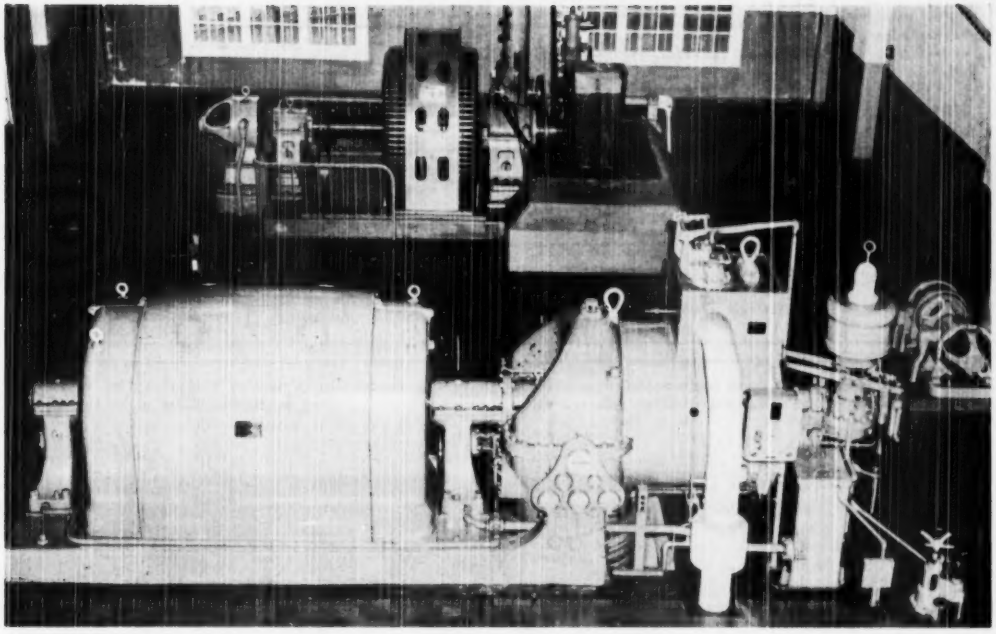
Old Plant. The former plant had grown from three marine-type boilers, used for process steam, and several waterwheels, to three marine, 13 hrt and two watertube boilers with a total of 36,600 sq ft of steam-making surface. Power equipment included three steam-turbine-driven generators and three hydroelectric generators, totalling 5100 kva, nine mechanical-drive water-wheels and eight standby steam engines used when water was low. Such a combination of steam and power equipment could not be expected to operate efficiently even though the plant had high reliability and a remarkable capacity for absorbing increased load demands. The answer was to install a new steam plant designed for modern mill-operating needs.

Less Wood Waste. By saving both labor and wood, whole-log barking and chipping have made manual methods obsolete. Converting more of the log into pulp reduces waste but leaves less for byproduct steam fuel. Amount of waste wood for fuel is further reduced by the increased demand for it as a raw material in higher-grade products.

Decrease in supply of waste wood and increased demand have raised its price. Nevertheless, cost of steam generated by burning wood waste is less at Woodfibre than that from any other available fuel.

These higher fuel costs, plus increased labor costs and greater power use, put more emphasis on plant and equipment efficiency than was justified when there was an excess of low-cost waste-wood fuel. Doubt regarding future hog-fuel supplies in British Columbia makes it wise to design new plants to burn more than one fuel.

Cost of fuel oil from California has increased and its use is restricted so there is no assurance of this fuel being available at reasonable prices. This



POWER GENERATION: Partial view of power plant shows 2500-kva condensing turbine and 2812-kva hydroelectric unit. Not shown are two 2500-kva turbines that use 570-psi 725-F steam, extract at 150 psi and exhaust against backpressure of 50 psi

Hog Fuel Efficiently

By W O STEVENS
Consulting Engineer, Seattle, Washington

directs attention to the burning of coal from one of the as yet undeveloped coal fields in the Province. All these factors had to be taken into account in designing the new plant.

Three Boilers Installed. To take advantage of the present supply of waste wood, two of three new 100,000-lb-per-hr boilers at Woodfibre are designed to burn hog fuel purchased in the open market and wet bark from the mill's barking plant. As long as supply of wood fuel permits, required steam will be produced by the two wood-burning boilers. These are fitted with five dutch-oven cells per boiler. Three cells are on the front and two on adjacent sides between the two boilers. These units have oil burners capable of operating them at rated capacity and of being put into service quickly should there not be enough wood fuel or should the wood-conveying system fail.

A third 100,000-lb-per-hr boiler (No. 1) is designed to burn oil only. It operates with one of the wood-burning units if available hog fuel can supply one boiler only. The oil-fired boiler is also used when slag from burning hog fuel from salt-water-borne logs must be removed.

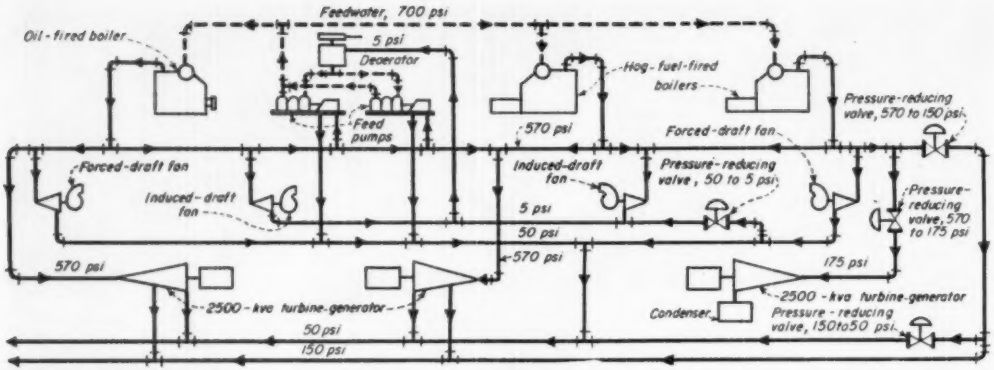
Boiler house is designed for installation of coal-storage pockets and pulverizers, if and when it becomes economical to burn coal. The two hog-fuel-burning boilers (No. 2 and 3) have hopper bottoms and combustion-chamber dimensions suitable for burning low-grade pulverized coal.

Dumping pin-hole grates are installed in the bottom of the combustion chamber of No. 2 and 3 boilers. Combustible in the carryover from the dutch oven settles out in the hopper bottom. Dampers admit preheated air through isolated sections of the pin-hole grates under the accumulated carryover. When the combustible has been burned, ash is dumped into an ash hopper below.

Slag Problems. Burning hog fuel from salt-water-borne logs creates operating problems foreign to plants with fuel not contaminated with salt compounds. The sodium constituents of the wood fuel pass through the combustion chamber in the form of a sublimate, and condense on the cooler heat-absorbing surfaces of boiler and superheater. First layer of slag is readily chilled by the watercooled surfaces and forms a dry, powdery coating. Subsequent layers are insulated from the tubes and are not subject to the same cooling action as the first layer. As a result, slag remains in a sticky or semi-molten condition and acts as a bond to hold particles of flyash to tubes.

As slag builds up, it gradually bridges between the tubes, and blocks the gas passage so the boiler must be shut down and cleaned. If slag is allowed to accumulate, the outer surface remains in a molten state. Then when boiler cools, slag forms an extremely hard vitreous substance, difficult to remove from tubes.

Improper mixing of air and combustible accelerate rate of slag formation. A reducing atmosphere tends to lower softening and fusion temperature of slag. Then, particles of incandescent carbon or ash adhere to heating surfaces, where they continue to burn until all carbon is consumed. Additional carbon particles continue to collect on



SIMPLIFIED FLOW DIAGRAM shows two noncondensing turbines extracting at 150 psi and exhausting at 50 psi. Forced-draft-fan and boiler-feed-pump turbines also exhaust at 50 psi. Induced-draft-fan turbines exhaust at 5 psi to heat feedwater

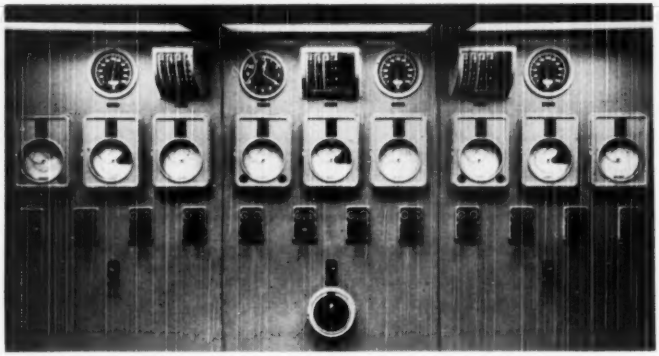
tubes and their burning tends to keep slag surface at an elevated temperature.

No. 2 and 3 boilers have a large proportion of black surface and an idle pass to cool the gas so as to reduce slagging of boiler passes. Additional access doors were installed and tubes were spaced to discourage bridging and help internal cleaning.

Burning of Flyash. Combustion-chamber turbulence is needed to burn flyash and carbon particles completely before they enter boiler passes. A simulated drop nose is formed by chrome ore on the stud tubes at the dutch oven's throat. This nose rolls combustion gas into the hopper bottom from two sides of the boiler. This action creates ideal conditions for bringing oxygen in air in contact with carbon in flyash and unconsumed volatiles from the dutch-oven cells. The higher the gas velocity the faster slag buildup on the tubes, so the boilers are designed for conservative gas velocities.

When burning wood, enough air must pass through the fuel bed to burn fixed carbon. If grates' outer edges are allowed to become bare, air velocity through them increases and light, partly burned fuel particles are carried over into the combustion chamber. For even distribution of undergrate air through the periphery of the hog-fuel cone, the dutch-oven-cell grate must be completely covered with fuel. To this end, fuel spouts have been so located as to ensure proper grate coverage when fuel piles have proper height.

Secondary Air. Dampered secondary-air ports in the dutch-oven top supply preheated air enough to burn volatiles in the fuel. Disturbing the hog-fuel pile on the grates increases carryover into combustion chamber. To reduce this



BOILER CONTROL PANEL mounts steam-flow air-flow meters, draft and other gages, combustion-control elements for all three units. Panel stands on dutch-oven deck

action, primary air through fuel bed is kept as low as possible consistent with good operation. In the dutch-oven roof, secondary-air openings are designed so air sweeps volatiles from the fuel pile while disturbing the fuel as little as possible and avoiding stratification of air and gas.

Hog fuel entering dutch-oven cells through fuel chutes acts as a natural air injector. Every pound of cool air that passes into the cells with fuel bypasses the air preheater and reduces boiler efficiency. To keep amount of air entering furnace with fuel low, an effective seal must be provided in the hog-fuel spouts. Negative pressure in the dutch-oven cells is used to keep unbalanced dampers in fuel spouts closed except when fuel enters the dutch oven.

Cinder Collectors. To prevent pulp contamination and to save the combustible in the flyash, gases from No. 2 and 3 boilers pass through multicyclone cinder collectors installed before the induced-draft fans. Air preheaters were designed to provide high-temperature (580 F) essential for burning wet bark and hog fuel.

Fans convey flyash from seal valves on cinder collectors to boiler combustion chamber in air-tight pipes. These pipes are insulated to prevent gas reaching the dewpoint at light loads and causing the pipe to block. Combustion gas is used to carry the flyash, which has a high carbon content. This prevents fires in the multicyclone hoppers and conveying pipes, which might result from inward leakage of air. Air in sufficient quantity to burn flyash is admitted through pinhole grates in the bottom of the combustion chamber.

Auxiliary and Main Turbines. Turbine drives on the forced- and induced-draft fans operate at 570-psig inlet pressure and exhaust at 50 psig and 5 psig, respectively. Exhaust pressures were

PRINCIPAL BOILER-PLANT EQUIPMENT

British Columbia Pulp & Paper Co, Ltd, Woodfibre, B.C.

STEAM GENERATION:

Boiler, waterwalls, air heaters, superheaters ..... Babcock, Wilcox & Goldie McCulloch, Ltd
Boilers, three, 2-drum, integral furnace, two with dutch-ovens; heating surface 11,727 sq ft; superheater, 1540 sq ft; waterwalls, 2900 sq ft; air heater, tubular, 18,800 sq ft; maximum gas temperature, in 800 F, out 480 F; max air temperatures, out 580 F; max continuous steaming capacity, 100,000 lb per hr; design steam conditions 600 psig, 725 F total temp; operating conditions, 550 psig, 725 F. Furnace, dry bottom, 7800 cu ft; Btu release per cu ft per hr, coal 24,500, oil 25,200, wood 35,400.
Boiler refractories ..... A P Green Fire Brick Co
Boiler heat insulation ..... Canadian Johns-Manville Co
Stacks and boiler breechings ..... Dominion Bridge Co
Self-supporting, three, 40 ft high, 8 ft inside diameter

COMBUSTION EQUIPMENT:

Automatic combustion controls ..... Bailey Meter Co, Ltd
Combustion-control air compressors, 30 cfm, 50 psi ..... Reavell & Co, Ltd
Soot blowers ..... Diamond Specialties, Ltd
Dutch-oven furnaces ..... F Drexell Co
Preheated-air design, divided by longitudinal walls to form five independent fire cells, furnace volume 2100 cu ft, grate area 342 sq ft
Suspended roof tile ..... Bigelow Liptack Corp
Ash gates ..... Babcock, Wilcox & Goldie McCulloch, Ltd
Oil burners 2 per boiler ..... Babcock, Wilcox & Goldie McCulloch, Ltd
Oil heaters ..... Graham Mfg Co
Oil pumps, direct-acting, steam ..... Smart-Turner Machine Co, Inc
Oil steam-pump governors ..... Fisher Governor Co
Oil constant-pressure relief valve ..... Bailey Meter Co, Ltd
Relief valves ..... Crane Ltd; Darling Brothers, Ltd
Oil-temperature regulator ..... Fulton Sylphon Co
Suction and discharge oil strainers ..... Darling Brothers Ltd
Forced-draft fans ..... Sheldons, Ltd
Two, turbine driven, 47,000 cfm at 6.5 in. wg and 105 F
One, turbine driven, 35,200 cfm at 7.4 in. wg and 105 F
Steam turbines ..... Babcock, Wilcox & Goldie McCulloch, Ltd
Two 76 hp, and one 63 hp; 4500 rpm; 550 psig, 725 F; back-pressure 50 psig
Steam-turbine reduction gears ..... David Brown & Sons
Induced-draft fans ..... Sheldons, Ltd
Two, turbine driven, 119,000 cfm, 13 in. wg, 505 F
One, turbine driven, 55,600 cfm, 5.2 in. wg, 380 F
Steam turbines ..... Babcock, Wilcox & Goldie McCulloch, Ltd
Two 352 hp, and one 79 hp; 4500 rpm; 550 psig, 725 F, back-pressure 5 psig
Steam-turbine reduction gears ..... David Brown & Sons
Multi-cyclone cinder collectors, two ..... Western Precipitation Corp

VALVES AND PIPING:

Safety valves ..... J E Lonergan Co
Nonreturn valves ..... Lunkenheimer Co
Blowdown and drain valves ..... Crane, Ltd
Steam-line gate and globe valves ..... Lunkenheimer Co
Oil-line valves ..... Crane, Ltd
Pressure-reducing valves ..... Kieley & Mueller, Inc
Feedwater valves ..... Crane, Ltd
Nonreturn valves on turbine bleed lines ..... Elliott Co
Piping contractor ..... Leak & Co
Pipe heat insulation ..... Canadian Johns-Manville Co
Expansion joints ..... Dominion Rubber Co
Traps ..... Strong, Carlisle & Hammond Co; Yarnall-Waring Co
Strainers ..... Yarnall-Waring Co; Leslie Co

FEEDWATER SYSTEM:

Feedwater chemists ..... Northwest Filter Co
Feedwater chemical pumps ..... Hills-McCanna Co
Feedwater heater (Cochrane) ..... Canadian Allis-Chalmers, Ltd
Deaerating, 300,000 lb per hr from 65 to 220 F
Feedwater-storage tank ..... Dominion Bridge Co
Feedwater regulators ..... Bailey Meter Co, Ltd
Water columns ..... Reliance Gauge Column Co
Feed pumps, turbine driven ..... Canadian Ingersoll-Rand Co
Three, 6-stage, 400 gpm, 750 psi, 4500 rpm
Feed-pump turbines ..... The Terry Steam Turbine Co
Three 350 hp, steam conditions 550 psi, 725 F, 50-psi backpressure

METERS:

Boiler control panels ..... Bailey Meter Co, Ltd
Steam-flow meters and multipoint draft gages ..... Bailey Meter Co, Ltd
Steam-pressure gages ..... Manning, Maxwell & Moore, Inc
Temperature recorders ..... Bailey Meter Co, Ltd
Temperature dial-indicators ..... Taylor Instrument Co's
Industrial thermometer ..... Taylor Instrument Co's
Oil-pressure and turbine-pressure gages ..... Manning, Maxwell & Moore, Inc
Turbine speed indicator ..... James G Biddle Co
Generator temperature records ..... Canadian General Electric Co

GENERATING UNITS:

Backpressure turbines ..... Elliott Co
Two, 2000 kw, 3600 rpm, throttle steam conditions 500 psig 725 F, automatic bleed at 150 psi, exhaust at 50 psi
Automatic control of 50-psig bleed ..... Elliott Co
Generators ..... Elliott Co
Two, 2500 kva, 4160 v, 0.80 pf, 3 phase, 60 cycle
Generator air coolers ..... Schutte & Koerting Co
Condensing turbine ..... Westinghouse Elec Corp
One 2000 kw, 3600 rpm, 175 psig, 400 F exhausting to surface condenser
Generator ..... Westinghouse Elec Corp
One, 2500 kva, 4160 v, 0.80 pf, 3-phase, 60 cycle
Condenser, surface 2000 sq ft ..... Westinghouse Elec Corp
Desuperheater and control ..... Bailey Meter Co
Impulse waterwheel ..... Pelton Water Wheel Co; Vancouver Engineering Works
One, 3650 hp, 912-ft head, 514 rpm
Generator ..... Canadian Westinghouse Co, Ltd
One, 2812 kva, 4160 v, 0.80 pf, 3 phase, 60 cycles
Waterwheel governor ..... Woodward Governor Co
Station switchboard ..... Canadian General Electric Co
Automatic voltage regulator ..... Canadian General Electric Co
Station transformers ..... Canadian General Electric Co
Lighting transformers ..... Ferranti Electric, Ltd
Oil circuit breakers ..... Canadian General Electric Co
Air-break circuit breakers ..... Canadian General Electric Co
Traveling crane ..... Herbert Morris Crane & Hoist Co

set to meet plant heat-balance requirements. Stepless speed control from turbine drives maintains balanced draft with a minimum of power at all times. On the oil-fired boiler steam-flow air-flow, fuel-ratio control adjusts fan speed. Air flow is varied according to steam flow on boilers No. 2 and 3 by automatic combustion control. Fuel feed is regulated manually. Steam leaves the superheater outlet at 570 psig and 725 F.

The main steam header adjacent to the division wall between boiler and turbine rooms is the distribution center point for high-pressure steam from the boilers. Nozzles connect directly to the 2500-kva, 150-psig extraction, 50-lb back-pressure turbine-generators. Another nozzle supplies a 570-psig auxiliary header for fan and boiler-feed-pump turbines in addition to the 570-to-150-psig pressure-reducing station.

A blanked nozzle provides for future installation of No. 3 turbine when and if the mill needs additional power. No. 4 turbine, a 2500-kva condensing unit, was moved from the old powerhouse. It is designed for 175-psig inlet pressure. A separate pressure-reducing station supplies required steam when this unit is used for standby service. Header nozzles for desuperheater atomizing steam and turbine auxiliary oil pumps

complete connections to main header.

Process and Heating Steam. Steam from the 150-psig extraction nozzles on the two new turbines goes to the 150-psig header in the boiler room. A 570-to-150-psig pressure-reducing station connects the two headers.

To obtain better power regulation and prevent hunting between turbines and pressure-reducing stations, which connect in parallel, no steam is permitted to pass through turbine extraction outlets until plant demand for 50-psig steam has been satisfied.

The forced-draft-fan and boiler-feed-pump turbines exhaust into the 50-psig steam header in the boiler room. Any deficiency of 50-psig steam is supplied through the 150-to-50-psig pressure-reducing station. This station cuts in only if turbine exhaust is not sufficient to hold header pressure.

Exhaust at 5 psig from the induced-draft-fan turbine is used for heating feedwater in the deaerator. When this is not enough, deficiency is made up through a reducing valve from the 50-psig header. Exhaust from the reciprocating fuel pumps is passed through the oil heaters and trapped to waste.

The mill requires process steam at 150 and 60 psig for bleaching, cooking, acid making, barking, drying, motive power and space heating. Desuperheater stations cool steam before it reaches the plant distribution system.

Heat is recovered in the power plant by passing feedwater through the generator air coolers, the heat exchangers for the watercooled dutch-oven grates and continuous blowdown.

Water from the deaerating heater is pumped by the turbine-driven boiler feed pumps to complete the operating cycle. Any two of the three boiler-feed pumps have capacity to handle maximum plant requirements. A motor-driven feed pump is not required for starting up purposes, as high-pressure water is always available from the penstock of the 2812-kva pelton-wheel-driven generator. The hydro unit uses the potential energy in the mill's water supply from Cedar Creek, which is impounded in Henrietta Lake, 1000 ft above the plant.

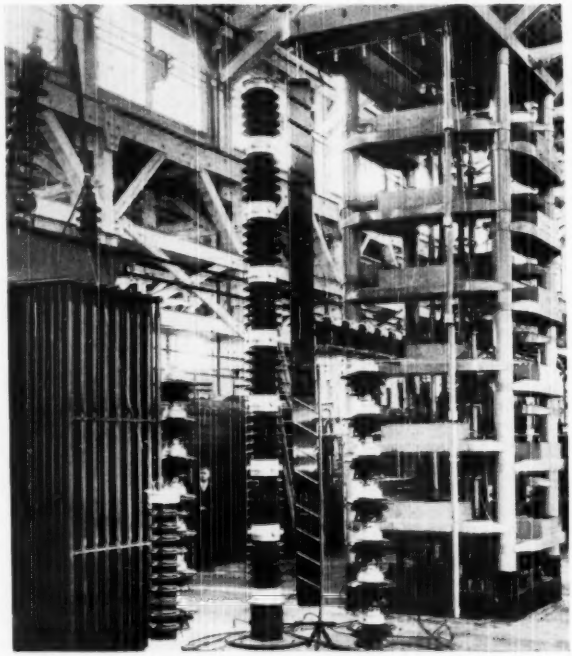
Boiler Feedwater. The pure water from the majestic mountains towering high above the mill is an ideal source of feedwater. Boilers are treated internally with phosphate to prevent silica in the water forming a tenacious and highly insulating scale. Soda is used to maintain the pH of the water at a safe value. A modern chemical laboratory is available for keeping a constant check on boiler-water concentration, chemical condition of feed and performance of deaerating heater in removing oxygen from the system. All tests are made as prescribed by Hall Laboratories, who have a contract for water conditioning and supply of plant chemicals. A pressure-type sand filter is utilized to remove any organic material that may be washed into the water at its source during freshets.

Plant is designed for maximum convenience of personnel, every consideration being given to operating conditions and comfort of the staff. Control office commands a panoramic view of boiler and turbine rooms. Combustion-control board can be seen through thermopane glass partitions on the boiler-room side, while the electrical panel in the turbine room is visible through the opposite window of the office. Inside the air-conditioned office itself are installed flowmeters, pressure gages and alarms from which the engineer can tell the performance of major equipment. Adequate and convenient lunchroom, locker-shower space and drinking fountains are a part of powerhouse facilities.

The quarry-tile floor and absence of piping and all unnecessary projections in the turbine room reduce to a minimum cleaning and maintenance of the dynamic-focal-color-painted equipment and building surfaces. The large door in the front of the powerhouse provides truck access to the boiler room under the turbine-room operating floor. A crane well in the operating floor permits removal of heavy equipment from trucks by use of the traveling crane in the turbine room.

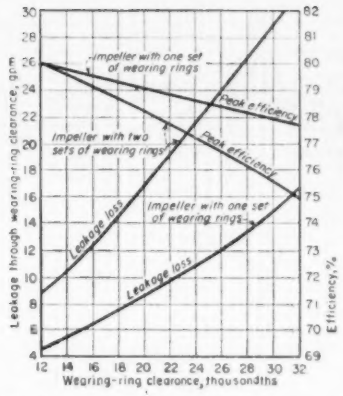
A modern metalclad cubicle type switchboard, mounted flush with the south wall of the turbine room, is the distributing point for 4160-v feeders from the powerhouse. The 550-v house transformer and load center is adjacent to the main board. Plant 4160- to 550-v transformer and load centers are located throughout the mill at strategic points.

Power is led to various load centers underground by 3-conductor, 500,000-cm, armored, lead-covered 5000-v cable.

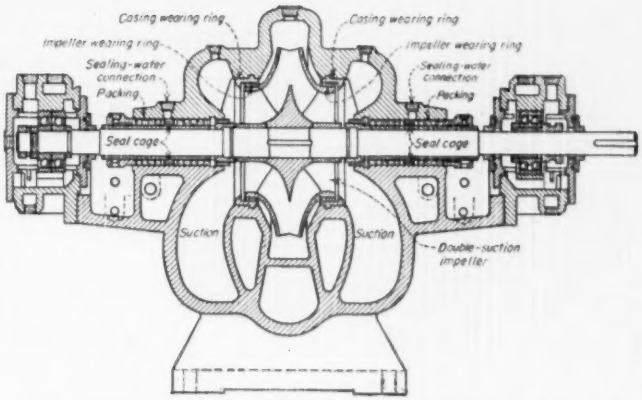


Surge Generator Tests Large Power Transformers

This lightning generator at Sunnyvale, Calif., works of Westinghouse Electric Corp has 24 banks of capacitors. These are charged in parallel to 10,000 v each and discharged in series to flash over a spark gap. Adjusting distance between gap spheres yields any voltage up to 2,400,000. Surge generator is charged in 20 to 30 sec by 440-v ac, which is stepped up and converted to dc by two 50,000-v rectifying tubes


Impeller with one set of wearing rings
Peak efficiency
Impeller with two sets of wearing rings
Peak efficiency
Impeller with one set of wearing rings
Leakage loss
Leakage loss
Leakage through wearing-ring clearance, gpm
Efficiency, %
Wearing-ring clearance, thousandths
30 28 26 24 22 20 18 16 14 12 10 8 6 4
82 81 80 79 78 77 76 75 74 73 72 71 70 69
12 14 16 18 20 22 24 26 28 30 32

1 Results of tests made to determine the effects of increasing wearing-ring clearance. Note how leakage losses mount



2 Centrifugal pumps have one or more sets of impeller and casing wearing rings to separate fixed and rotating parts

Good Wearing Rings Make Good Pumps

Tests show the cost of losses through worn rings. Here's the information you need to keep wearing rings in good condition, avoid these losses, maintain high centrifugal pump efficiency

By H E TRACY
Engineer,
Byron Jackson Co

► PUMP USERS often think of wearing rings as simple, renewable parts, to be replaced when worn or when they get around to it. They don't realize that these rings are important factors in pump performance into whose design a lot of study and experimental work have gone. Modern pumps require that wearing rings operate in pumping temperatures from below zero to 800 or 900 F. They must resist corrosive liquids and often abrasive materials. So an understanding of the part these rings play in good centrifugal-pump operation is essential to plant engineers.

Nearly all centrifugal pumps have one or more sets of impeller and casing wearing rings. They separate rotating and stationary parts and form a throttle between high- and low-pressure areas within the pump. Wearing rings on the impeller rotate with it. Wearing rings in casing fit into it and are stationary. Clearance between these rings governs leakage from high- to low-pressure areas.

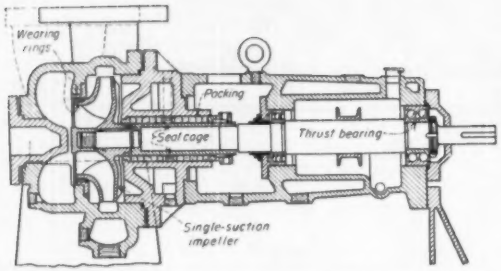
Clearance. A wearing ring is not a bearing but should have uniform clearance around its circumference. This should be maintained during operation. Precautions taken to prevent shaft and casing deflection and hold equal clearance include: saddle mounting to reduce uneven casing expansion for hot-service pumps, double-volute construction for radial hydraulic balance, shafts heavier than needed for torsional stresses, etc. Although these assist, they do not entirely eliminate deflection. Pipe-imposed strains on the pump casing, bearing wear, unbalance of rotating parts from wear, coupling misalignment and deflection of long impeller shafts due to static weight are factors that cannot be accurately predetermined.

Pump designers recognize this problem and, when possible, select materials for wearing rings so they may run as a bearing, lubricated by the pumped liquid. If materials that tend to gall must be used, designer makes clearance between rings large enough so there is little chance of contact. He must be careful, however, because as clearance increases, leakage loss rises and efficiency falls.

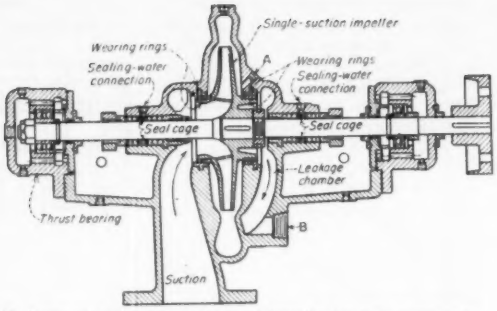
Leakage Tests. That we may better understand leakage as related to increased clearance, Fig. 1 gives results of one of a series of tests run some years ago. These tests were made on one of our 3-in., horizontal, single-suction split-case 475-gpm 168-ft-head pumps with 4⅛-in. wearing rings. (*See transactions, ASME, Vol 54, No. 15, pp 65-111.*)

To separate leakage water from main flow, we provided a chamber on the back side of the impeller, Fig. 4. Wearing rings separated this chamber from that part of the pump casing under discharge pressure. Pressure at wearing rings was measured at tap *A*. Leakage discharged through a 1½-in. diameter nozzle, at *B*, and was weighed. Pump ran with constant pressure of 50 psi at wearing rings, tap *A*. Speed was about 2500 rpm, but was increased slightly to maintain 50 psi, and compensate for increased leakage when testing wearing rings with increased clearance.

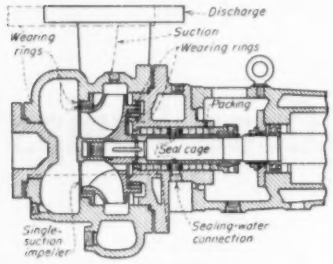
Effect of Clearance. Wearing rings were identical in width and type but were installed with progressively increasing clearances. Fig. 1 gives values of leakage obtained. With 0.012-in. clearance in one set of rings, leakage



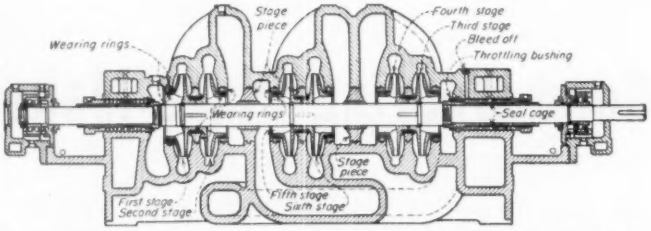
3 This single-stage single-suction centrifugal pump has two wearing rings: one in the casing, other on the impeller



4 Pump with chamber at back of impeller for test to measure leakage through wearing rings having different clearances



5 Single-stage single-suction unit has two sets of wearing rings, as shown



6 Multistage pumps with stage pieces between impeller groups, throttle bushings on balancing drums, have additional places where leakage increases with wear

runs 4.4 gpm, 0.93% of total capacity. At 0.020-in. clearance, leakage doubles: 8.8 gpm or 1.85% of total capacity. With 0.030-in., leakage mounts to 14.5 gpm or 3.06%. With certain wearing-ring metal combinations, initial clearance must be increased from about 0.012 to 0.020 in. to prevent galling. To have a 0.020-in. clearance, due to wear, is not uncommon after only short periods of operation.

Efficiency Loss. Peak-efficiency curve shows this loss in terms of reduced pump efficiency. With wearing-ring clearance of 0.012 in., pump has a peak efficiency of 80%. When clearance increases to 0.020 in., peak efficiency drops to 79.1%, while with 0.030 clearance, it goes down to 77.8%.

So far we have considered only a single set of rings. Most pumps have two sets for each impeller. All double-suction single-stage, Fig. 2, single-suction balanced types, Fig. 5, and all multistage pumps have two sets of wearing rings for each impeller, Fig. 6. Multistage pumps with stage pieces between impeller groups, throttle bushings, or balancing drums, have additional points where leakage losses rise with increased clearance.

Assume the 3-in. test pump has two sets of wearing rings with 0.012-in. clearance and 80% efficiency. Fig. 1 shows that if leakage loss is doubled, reduction in efficiency is much greater. With 0.020-in. clearance, efficiency is 78.2%, and with 0.030 in., efficiency drops to 75.5% as compared to 77.8% with one set of rings.

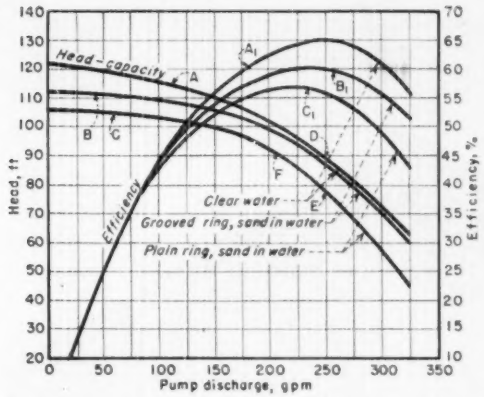
Fig. 1 does not apply to all centrifugal pumps, as leakage varies with head produced by the impeller, and with ring diameter. This is, however, a typical example. It is given to stress the importance of selecting materials that (1) do not tend to gall or seize, requiring greater initial clearance and (2) do not wear rapidly because of abrasive action.

Effects of Abrasion. Abrasion is a real enemy of wearing-ring clearance. Surface-hardened or heat-treated materials help in varying degrees to prevent wear. To further assist in reducing wear because of abrasion, spiral grooves are often used, Fig. 8. These grooves are cut, either in inside diameter of casing wearing rings, or on outside diameter of impeller wearing rings—whichever is the softer material.

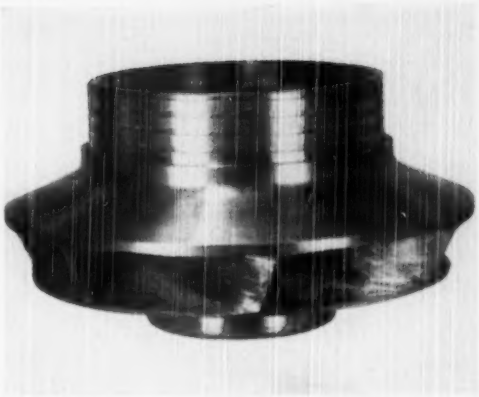
We discovered the advantages of grooves in 1931 during an attempt to increase life of wearing rings used in deepwell turbine pumps, which at times had to pump water containing sand. Starting with the assumption that a deepwell turbine should have reasonably close wearing-ring clearance to maintain good pump efficiency and yet permit sand particles to pass through the clearance, a spiral groove was developed. This method, though very simple, is quite effective.

Two 5-stage, 250-gpm deepwell turbine pumps were built. These units were identical except that one had plain wearing rings and the other had spiral grooves cut on the outside of its impeller rings. Both pumps were installed in a concrete pit, containing water and an abrasive sand. Both ran for a period of two weeks, then were interchanged in position in the pit and ran for two additional weeks. This was done so all operating conditions during the 4-week test would be as nearly identical as possible.

Fig. 7 compares head, capacity and efficiency of these pumps before and after the 4-week run. Curves A and A_1 show head-capacity and efficiency when pumps were tested in clear water before making the test in water containing



7 Characteristic curves of two deepwell pumps tested with clean water and after 4-week run with water carrying sand



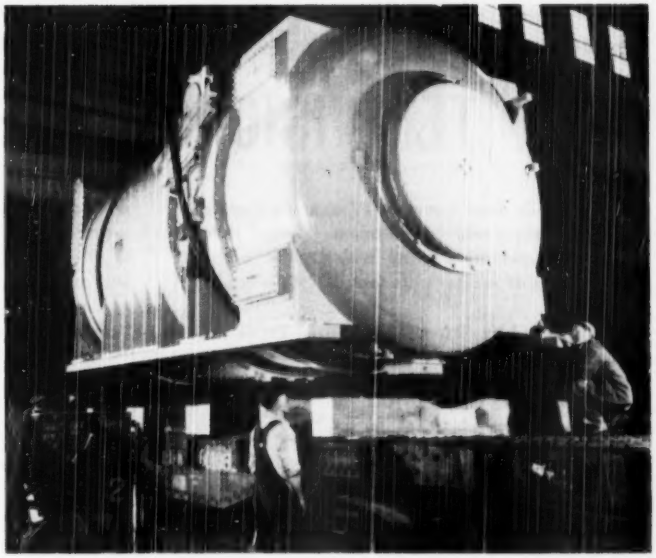
8 Deepwell turbine-pump impeller with spiral groove cut in its wearing ring to reduce abrasive wear and leakage loss

sand. Curves *B* and B_1 give head capacity and efficiency of the pump whose impeller had a spiral-grooved wearing ring after four weeks running in water containing sand. Curves *C* and C_1 give similar test results of the pump whose impeller had plain wearing rings.

Test Results. Curves show that these pumps when tested in clear water were good for 250 gpm at 90-ft head, point *D*, before starting the 4-week run in water containing sand. At the end of the 4-week run the pump with the plain wearing ring could deliver 250 gpm at a head of only about 77 ft, point *E*. Or if it had to operate at 90-ft head, capacity would decrease to about 210 gpm, point *F*. Compared to these losses those for the impeller with the grooved ring are small. Comparing efficiencies, that of the impeller with the spiral-grooved wearing ring drops only about one half that of the pump that has the plain ring.

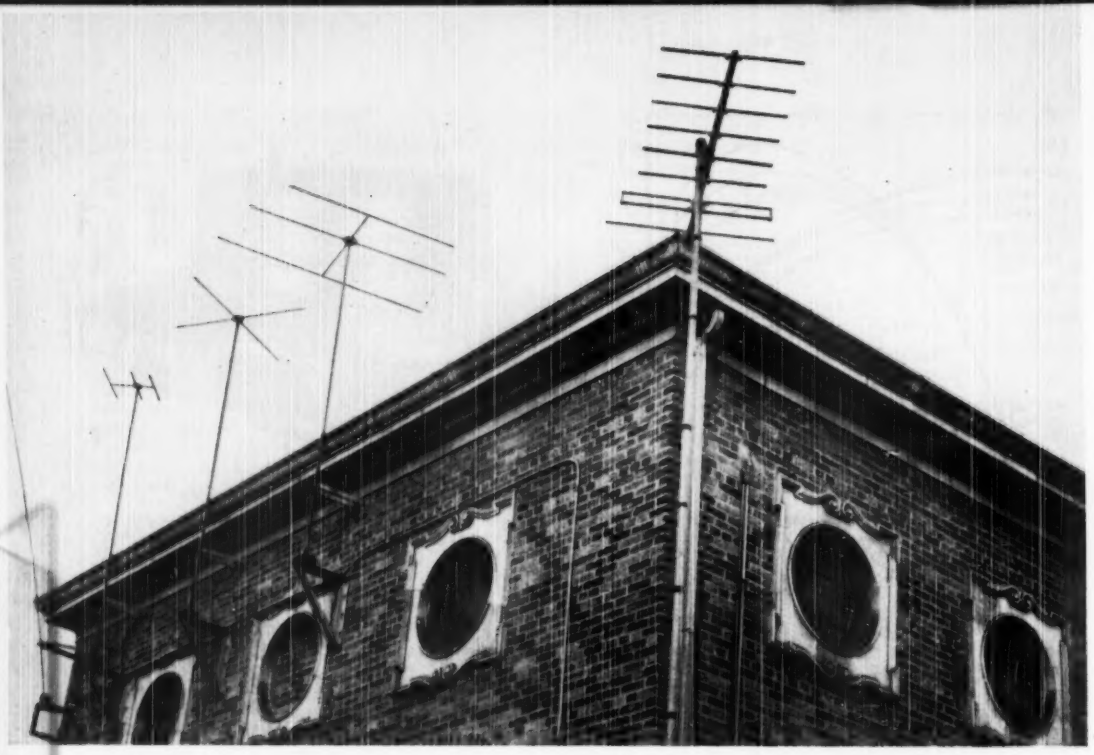
This and other tests show that spiral grooves increase life of wearing rings in some abrasive services. They are not intended to be a cure for handling abrasive liquids, such as slurry and sand, but are helpful when pumping liquids that contain a small amount of pipe scale or other abrasive matter. We have found, too, that these grooves assist in preventing galling. Apparently small particles of abrasive matter that rotate with the liquid and enter the wearing-ring clearance, find these grooves and follow them to their outlet. We know from tests that concentric grooves tend to reduce leakage loss. It is reasonable to expect that spiral grooves would increase leakage loss slightly. But tests run in our laboratory indicate that this is negligible.

It is our practice to cut these grooves 3/32 in. wide by 1/32 in. deep with a right-hand spiral. It has been determined that, regardless of whether the spiral runs counter to or with the flow, its effectiveness is the same. For wearing rings under 2-in. width, three grooves per inch are used. Wearing rings, stage pieces or throttle bushings 2 in. or more wide have 1½ grooves per inch of width.



Big Synchronous Condenser Shipped Assembled

Built by Allis-Chalmers, this 42,000-kva hydrogen-cooled unit starts on its way to U. S. Bonneville Power Administration, Snohomish, Wash. It is designed so exciter housing can be sealed from rest of machine at standstill. This permits inspection of commutator and collector ring without loss of hydrogen from condenser chamber



1 Four of the six RCA master TV antennas reach up over rooftop of New York City's Park Lane Hotel. Each covers but one channel and is "beamed" accordingly. Other systems are also available that use but one all-channel antenna, Fig. 8

Up-to-the-Minute Answers to Your Questions on . . .

TELEVISION MASTER ANTENNAS

Do you really need a master TV antenna system in hotels, institutions, department stores? Won't portable antennas do the trick? What are the advantages of master antennas . . . at what cost?

Will color television make the present master systems obsolete? And what about the FCC's plan to allow transmission at uhf . . . will that work with all master systems installed today?

Read what IRA KAMEN and RICHARD H DORF have to say on this timely subject *

What are major objections to individual outdoor antennas on roofs of hotels, institutions, department stores, etc?

Poor reception at each receiver forms biggest objection. That brings up this matter of "ghosts". Let's say an individual antenna has been installed and reception is good. That is, it's good unless you happen to receive the regular direct signal from the transmitter plus an indirect or ghost signal. Ghosts are reflections of the original signal bouncing off any of the nearby buildings or objects.

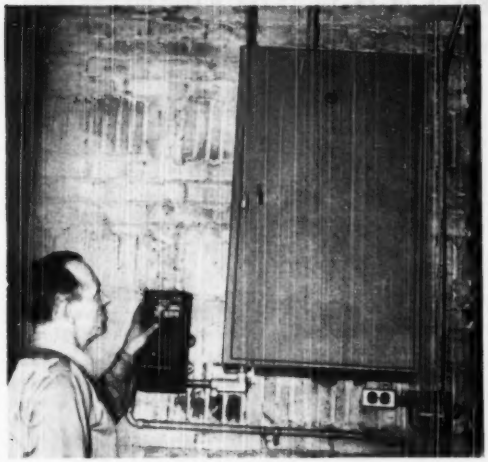
Since these ghosts take longer to arrive than the regular signal, you get repeat images on the screen that are physically displaced or out of phase. Only way to avoid them is by turning antenna so signal picked up does not include reflections.

Then, too, every TV receiver is a small transmitter since it contains an oscillator. A receiver tuned to one channel gives off a signal that may be precisely that of another channel. This self-generated signal spouts out of the antenna and radiates to others.

Let's take a typical case. Receiver *A* is tuned to channel 2. Receiver *B*, whose antenna is on the same roof and perhaps only inches away, is tuned to channel 5. Receiver *B* catches the oscillator signal from receiver *A* along with its regular reception. As a result, picture of receiver *B* may be washed out. At any rate it will probably show closely spaced black lines across the

* Ira Kamen is Director of Television Development and Promotion of Brach Mfg Company. Richard H Dorf is a Television Consultant.

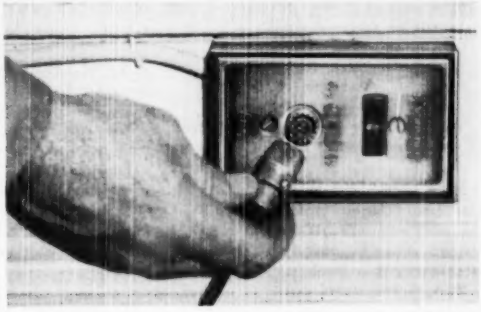
TV SIGNAL IS CARRIED FROM ROOF TO AMPLIFIER TO RECEIVER BY COAXIAL CABLE



2 Asst Chief Engineer Gregory Kunkel makes a routine check on amplifier and the constant-voltage transformer to left

3 Coaxial cables leave the amplifier and run through hanging ceiling of top floor to small distribution transformers

4 Riser-cable junction boxes at pipe-shaft trap door in each kitchenette. Plug-in coaxial cable runs open to receiver



5 Open cable is run around molding in initial installation. Then cable is chopped into wall when suite is repainted

picture. This situation exists to a varying degree wherever there are several individual antennas on one roof.

Few buildings have roofs large enough to accommodate all antennas needed. And if they did, haphazard individual installations would ruin the building's appearance. Then there's the possibility of improperly installed antennas toppling into the street. And even good ones make hurdles for firemen.

Are portable or built-in TV antennas practical where many receivers are used in one building?

Portable or built-in antennas seldom give good results in modern steel buildings. Television reception is quite different from that in the broadcast band. TV signals in vhf (very-high-frequency: 30 to 300 million cycles per second) and higher bands travel in almost straight lines. They will not pass through most objects. Little or no signal is likely to enter the average hotel suite under its own power. First there's this matter of building steel shielding the signal. And all apartments can't face all transmitters. So no matter how good the indoor antenna, it just can't catch a signal that isn't there.

It's true that some signals bounce into rooms through reflections from walls of adjoining buildings. But they represent many simultaneous reflections and show up poorly on the screen. Now you can see why you have to keep turning an indoor antenna for good reception on each channel.

Built-in, non-turning antennas work largely because of signal amplification within the receiver. But such amplification is equally effective on ghost signals; that's how you get "snow" in the picture.

Under what conditions would a portable out-the-window antenna give satisfactory service?

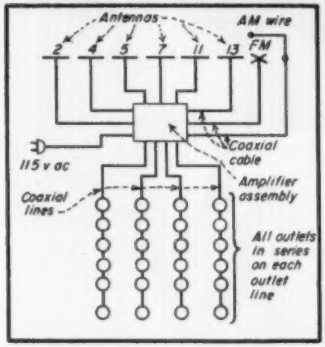
You'll get reasonably good results on some channels *when the window faces the transmitter*. In addition to being ineffective on some channels, they form a falling hazard and mar general appearance of the building.

What is a master TV antenna system?

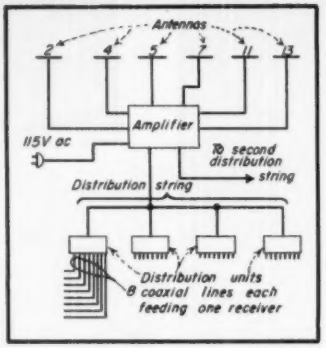
A series of antennas (one for each channel) or a single antenna to handle all channels, and some means of distributing the signals received to many receivers. It includes means for reducing oscillator interference by isolating sets from each other. It may also include an amplifier to strengthen weak signals.

What are principal differences between available systems?

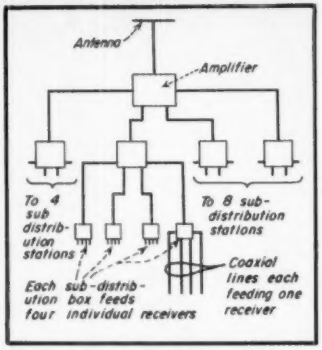
METHOD OF DISTRIBUTION IS THE BIG DIFFERENCE IN THESE THREE POPULAR SYSTEMS



6 *RCA Antennaplex* may have distribution transformer after amplifier, Fi. 3



7 *Jerrold Mul-TV* allows simple on-off control, is suited for pay-as-you-go


Antenna
Amplifier
To 4 sub distribution stations
To 8 sub-distribution stations
Coaxial lines each feeding one receiver
Each sub-distribution box feeds four individual receivers

8 *Brach Mul-Tel* uses one antenna and amplifier; one line to each receiver

At present there are between 10 and 20 systems. They differ in:

1. Antennas: one all-channel or several single-channel
2. Amplification: Presence or absence method
3. Outlets: Maximum possible

What are the high points of three of the more popular systems?

Most useful systems are those with amplifiers. Three typical systems in this category are RCA *Antennaplex*, Jerrold *Mul-TV*, and Brach *Mul-Tel*. Here's how they stack up:

RCA Antennaplex uses a separate antenna for each channel, Fig. 1 and 6. Each antenna lead feeds one of several amplifiers all in the same cabinet, Fig. 2. Amplified signals are then mixed and distributed into a single coaxial line. This line may feed into a transformer having four outputs. Each output then forms a riser.

Advantages of this system are:

1. Sufficient amplification to provide good signals from weak stations. Take a typical case in the New York city area. Station WATV on channel 13 is received about as well as all other stations. And that is not true of most receivers with individual antennas.
2. Minimum of vacuum tubes, and hence of replacements. Each of seven channels contains about three tubes. The total for an average installation in New York city is 27 to 30.
3. Good isolation reduces effect of receiver oscillation.
4. Since outlets may be tapped off at any point along the line this system is well suited for hotel installations. Risers may be dropped down a pipe shaft and tapped at each suite.

Jerrold Mul-TV. Here again we have individual channel antennas and an amplifier for each, Fig. 7. Amplifier outputs are mixed and feed off in two starting risers. In an apartment-house installation each starting riser feeds a series of vacuum-tube rigs. These may be located at the amplifier or distributed throughout the area to be served.

Each distribution unit in the string contains eight vacuum tubes, one furnishing signal for each outlet. You can use as many distribution units as needed, depending on number of outlets to be supplied. The only limitation is that no cable, whether from amplifier to distribution device or from there to an outlet, should be more than 500 ft long.

In most cases the 8-tube distribution units are mounted alongside the amplifier. Individual cables are then led off to each outlet. In stores and showrooms, however, starting risers from amplifier may be carried around the room and 1- or 3-tube distribution units inserted in the line at intervals to feed one or three receivers in a group.

Advantages of *Mul-TV* system are:

1. When there is a pay-as-you-go arrangement the hotel operator can disconnect any outlet by flipping a switch or removing a tube in the centrally located distribution unit.
2. All tubes are centrally located, simplifying maintenance.
3. Excellent isolation between receivers.

Brach Mul-Tel. Outstanding feature of this system is a single all-channel, high-efficiency antenna feeding a single 12-tube amplifier. Each of four amplifier outputs feeds one distribution unit. Each distribution unit in turn has four outputs, each feeding a sub-distribution station. By this succession of splits, as many as 64 outlets may be supplied.

Amplifier output is about six times input. This compensates for losses in cables and distribution units. Signal at receiver is substantially the same as would be had with individual antennas. But isolation between sets is provided. An additional amplifier may be added in weak-signal areas.

Advantages of this system are:

1. Only a single antenna need be used. This is advantageous where ghost signals are not serious.
2. A single amplifier is used. Hence failure of any of the 12 tubes has no serious effect other than a slight weakening of signal.
3. Only portion of the system using vacuum tubes is the amplifier. This reduces maintenance problems.

Assuming labor costs as they are in the New York city area, what is unit installation cost per 100 receivers for each of these systems?

Average costs including labor and equipment will run between $4000 and $6000 for both the RCA and Jerrold systems. The Brach one-antenna system will cost less. The above figures will vary widely depending on difficulty of installation, especially in existing buildings. Costs are invariably lower where a system is put in a building under construction.

How close are we to popular use of color television?

It's safe to say that color television will begin commercially within 4 to 5 years at outside, assuming development work is not interrupted. This is our opinion. The only sure thing is that color TV will come in near future.

Will advent of color TV affect master antenna systems now installed?

Color TV will have a sweeping effect on antenna installations. Reason: with color it is essential that there be no ghosts. If there are, two images appear. They mix and produce an entirely unforeseen result. Edges of color areas get muddy and indefinite and entire scene loses its value.

At present we can often ignore mediocre black-and-white reception. When everything is merely a shade of gray, changing the shade slightly (ghosts), or introducing interference, merely produces a change in degree. With color TV, however, anything that mars the picture will change it in nature. Depending somewhat on the type color system finally agreed upon the color pattern may be destroyed by interference or low signal level.

Here's what all this boils down to: Any master antenna system installed today should produce high-quality, ghost-less images on every channel. Otherwise it may turn out to be a wasted investment when color comes along. We feel that advent of color TV will prove the turning point in acceptance of master antenna systems by even the last holdouts. Individual antennas will then be obsolete and useless except in favored areas.

Present television is beamed at vhf (very-high-frequency). Since plans are afoot to transmit on uhf (ultra-high-frequency) will this have any bearing or require any changes in master antenna systems?

Present plans of the Federal Communications Commission (FCC) do not call for changing vhf assignments to uhf. And it's difficult to say what they will decide on. But it's safe to say that few areas will have both transmitting plans in operation together. When uhf stations crop up it will probably be in new TV areas. However, present master antenna systems that are in fringe sections can handle both if a converter is used along with present amplifiers.

These converters change uhf signals to vhf signals that can be handled by any ordinary receiver. Converters have already been designed by makers of present amplifiers. Of course it is possible that new antenna systems may be designed especially for uhf areas. This is unlikely since uhf signals are difficult to distribute from antennas to outlets.

Is there any maximum number of receivers that can be tied in on one master antenna system?

From a strictly practical viewpoint there is no real limit to number of outlets that can be fed by an amplified master system. Usually, however, some maximum number is specified. But if there is need for additional outlets extra amplification can be supplied at the point where signal gets weak.

What provision should be made in planning a new building to insure adequate TV reception?

A master antenna system should be selected and all plans for its installation completed before any actual physical work begins. Remember that some systems adequate today may run into snags with color or uhf. It will pay to call in a TV consultant at this stage of the game.

What are some considerations in planning a master antenna system for an existing building? What tests and adjustments must be made before system can be put into operation?

Assuming system has been selected with a view to fulfilling existing and future needs, some of the details are as follows: Planning the riser scheme, selecting weatherproof location for amplifying equipment, surveying for best antenna sites, providing ac receptacles close to TV receivers, etc.

In almost every case the manufacturer of the antenna system sends a field engineer to make final tests and adjustments. These checks include lining-up antenna, amplifier tuning, testing each outlet to see that a signal is coming through, etc.

Is it customary to have an individual or group specializing in master antenna systems prepare specifications that can be followed by a local electrical contractor?

This is the common procedure. Each manufacturer usually distributes his system through franchised dealers in each locality. Dealer and building TV consultant then cooperate in planning the layout. Final plan is then sent to the manufacturer for approval. After his engineers give it the OK it is turned over to the electrical contractor who executes the plan.

Big difference between TV antenna installation and ordinary electrical work is that the coaxial cable used requires special handling because of the high-frequency currents.

Is there any "standard" packaged system that can be bought and installed by a building maintenance crew?

There are a few firms that make components and are willing to sell them to anyone. Most manufacturers, however, feel they have an obligation for the success of every system using their equipment. And for that reason they insist on overseeing every job.

What is the most practical way to run the necessary wiring throughout the building?

Conduit is used within the walls of a new building. But in an old building the coaxial cable is often run open in pipe shafts, Fig. 4. Existing conduit connected with a broadcast-antenna system may often be used. Another method runs conduit through stairwells and vertically-connecting closets.

Is open coaxial cable approved by the Underwriters Laboratories for connection between outlets or as risers?

Yes. Coaxial in a master TV system carries only a few volts to ground. It may be used without objection from Underwriters.

What periodic maintenance is needed on a master installation?

Practically the only maintenance required in an amplified system is tube replacement. However, with modern tubes this should be no more often than once a year unless there are unusual voltage surges on local ac supply.

With many amplifiers, tube replacement calls for amplifier retuning. This is the work of an electronic serviceman (electronician). A defective amplifier with its plug-in arrangement may be removed in a few minutes and a new one snapped in place. Thus the channel is restored to operation immediately. Local service organization can repair amplifier plug-in rig at leisure and hold it as a spare.

Under what conditions will it be necessary to change the location and "beaming" of each antenna?

Ordinarily only if transmitter location is changed. It is possible, however, that a nearby new building would interfere. This would call for altering antenna setup somewhat.

Is it practical to combine, and install at the same time, a master TV, FM and AM antenna system?

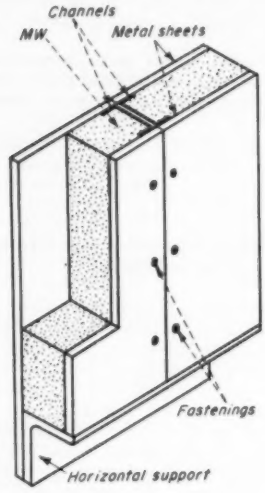
Yes. It is suggested by the makers of most amplifier systems. It's simply a matter of installing two additional amplifiers, one for AM and the other for FM.

Even though the FM and AM are to

(*Continued on page 156*)

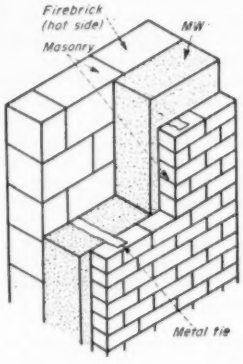
How To Apply Mineral Wool Heat Insulation

By PHIL SWAIN, *Editor*



BETWEEN MASONRY WALLS

Use flat metal ties like those for building construction. Walls support insulation. Ties help hold masonry together

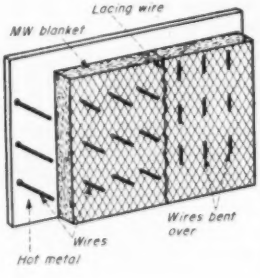


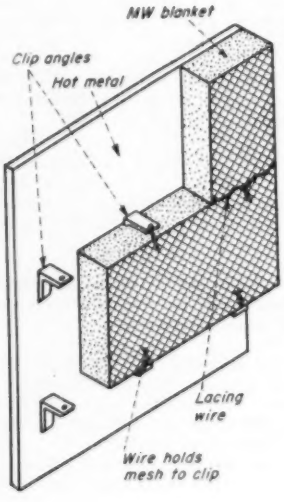
BETWEEN METAL SHEETS

Fasten outer and inner sheets to structural channels or I-beams. Support insulation from below

BLANKET, WIRE-IMPALED

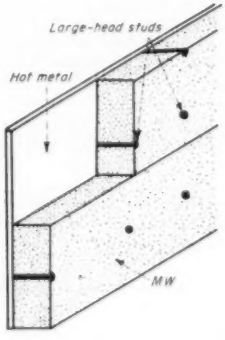
Spot-weld wires to heated metal surface. Impale insulation and bend wires over its face. Lace edges of blankets together with galvanized wire





CLIP-ANGLE SUPPORTS

Blanket held in place by metal mesh wired to clip angles at suitable intervals. Lacing wire joins abutting edges



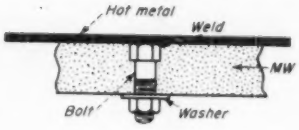
STUD-GUN WELDED

Insulation attached by studs inserted through it and welded to metal surface behind by gun-type equipment

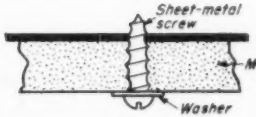
Note: In all the drawings shown here MW stands for mineral wool.

Practical know-how for all types of power equipment. Drawings and condensed instructions summarize standard procedures in U S Dept of Commerce Commercial Standard CS117-49, *Mineral Wool Insulation For Heated Industrial Equipment*, 2nd Ed, 1949

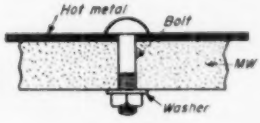
FOUR SUPPORTS



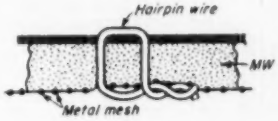
Bolt Heads welded to metal surface, *upper left*. Large washer increases bearing area on insulation



Sheet-Metal Screw and washer hold insulation in place on heated metal surface, *lower left*

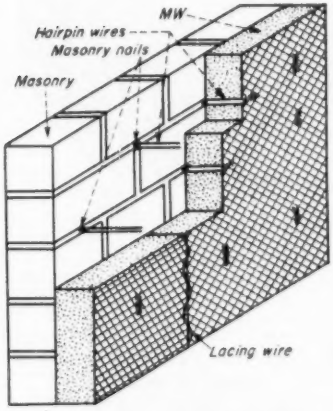


Bolts Through Drilled Holes in heated surface hold insulation. Washer gives larger bearing area, *upper right*



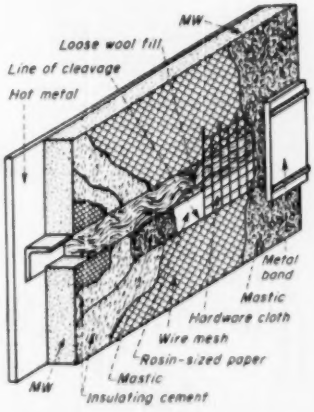
Hairpin Wires and metal mesh, *lower right*. Wires pass through twin holes in heated surface and insulation. Twist together to hold blanket in place

NAIL FASTENING, MASONRY WALLS



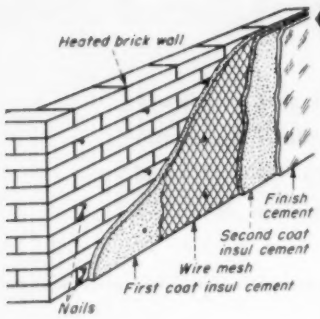
Drive masonry nails into joints and fasten hairpin wires to nail heads. Apply blanket insulation with metal-lath face exposed. Secure with hairpin wires. Tightly butt blanket edges and lace together or tie at frequent intervals with 16-gage galvanized wire

EXPANSION JOINT, LARGE METAL VESSEL



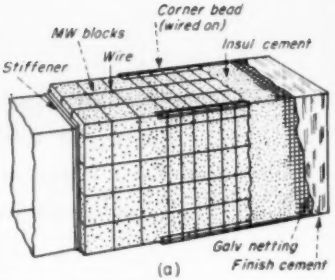
Use every 12 to 16 ft on equipment with temperature greater than 600 F. Leave 1½- to 2-in. space between rows of blanket. First apply a ¼-in. coat of insulating cement, then a 4-in.-wide strip of asphaltic mastic over cement just below space between blankets. When dry, fill space with loose mineral wool. Then apply second coat of cement over all except loose wool and mastic. Stretch 20-gage 1-in. wire mesh over cement and secure in place. Do not cover expansion-joint space. Cover mastic strip first with rosin-sized paper and then both expansion joint and paper strip with 1¼-in. mesh hardware cloth. Lace cloth to mesh, leaving bottom free to move with expansion and contraction. Cover entire vessel with weatherproof mastic leaving a line of cleavage at lower edge of each cloth. Metal-band protector may be added over expansion joint

For more insulation facts, turn page ▸



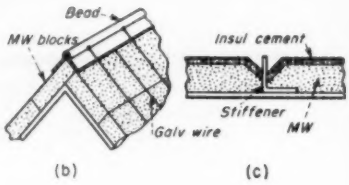
CEMENT ON BRICK WALL

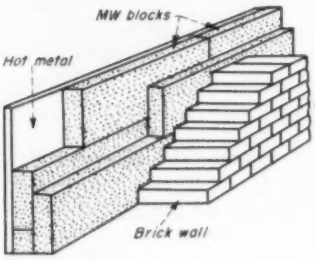
Drive masonry nails into joints on about 12-in. centers, heads projecting about ¾ in. Apply layer of insulating cement until proper thickness is obtained. Apply wire netting and secure to nails before last layer of insulating cement. Then apply cement or asphaltic finish



FLAT SURFACES

(*a*) shows application where insulation thickness is greater than stiffener height
(*b*) is detail of a corner bead
(*c*) applying insulation when thickness equals or is less than stiffener height



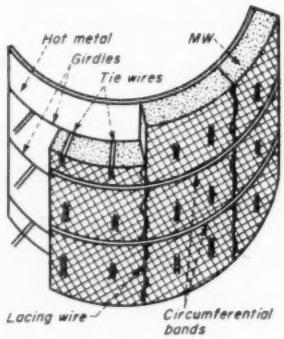


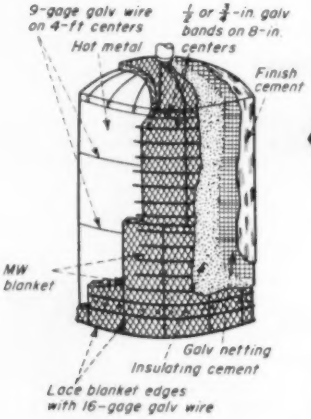
FURNACE WALLS

With each wall self-supporting merely lay in blocks or boards, staggering the joints. Butt tightly

BLANKET ON TANK: 1

With expanded-lath side exposed, secure blanket to supports. Butt edges tightly, then lace together or tie at frequent intervals along the edges with 16-gage galvanized wire. Lastly, band or wire circumferentially



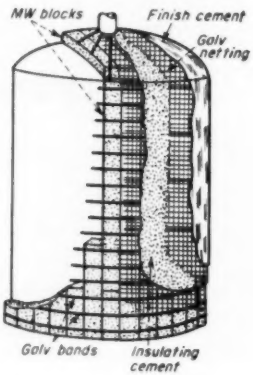


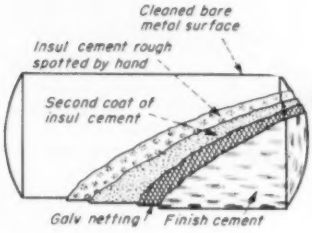
BLANKET ON TANK: 2

Round surface makes it easy to bind blanket insulation firmly to the metal. Blanket is held by wire girdles, lacing, netting and bands

BLOCK, BOARD ON TANK

Butt blocks or boards closely together with joints staggered. Anchor blocks. Then fill voids with insulating cement. Stretch galvanized-wire netting over blocks and apply insulating cement. Stretch second layer of netting and finish with cement or asphaltic



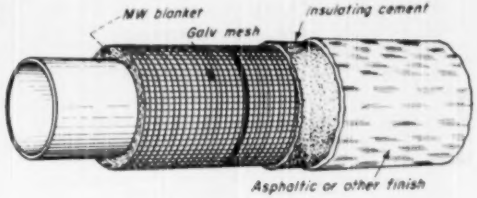


CEMENT ON TANK

Spot first ¾-in. layer by hand, roughing in completely. When dry, apply single layers, ¾-in. thick or less. Use netting for total thickness over 2 in., tanks which vibrate, or on under sides

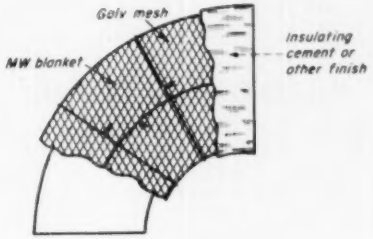
BLANKET ON PIPE

Form insulation roughly to fit pipe before applying. Put on pipe and pull longitudinal edges tightly together. Tie or lace with 16-gage galvanized soft-iron wire. Keep seam on lower side of pipe. Space insulation far enough from flanges to allow bolt removal. Apply insulating cement and finish



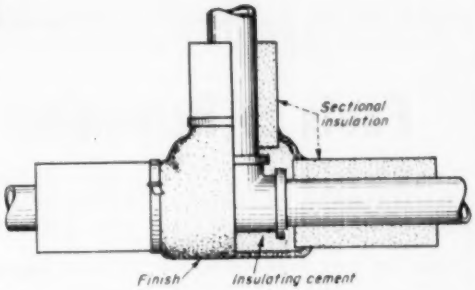
BLANKET ON PIPE FITTINGS

Valves, flanges and fittings for pipes 2-in. and larger should be insulated with blankets the same thickness as on adjacent piping. This insulation is applied after that on pipe. It is formed to fit by cutting, wired in place. Lace the edges. Insulating cement or blocks may be used instead of blankets



INSULATING CEMENT ON FITTINGS

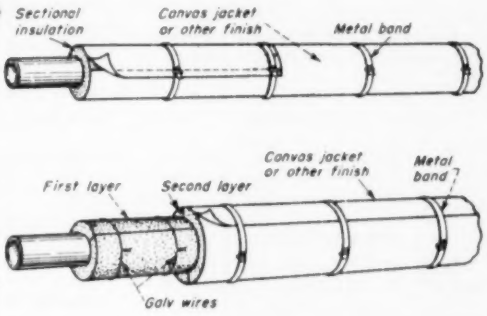
First coat of sufficient thickness must dry and form an even base for two separate ¼-in. finishing layers. Pipes, valves, flanges and fittings may be finished with roofing-felt, an asphaltic coating or a canvas jacket. Roofing-felt is held in place with copper-clad steel wires, copper wires or galvanized bands. Asphaltic finish is reinforced by galvanized-wire netting. Canvas jackets must be sewn or pasted over a layer of flame-proof asbestos paper or a ¼-in. coat of insulating or finishing cement



SECTIONAL PIPE COVERING

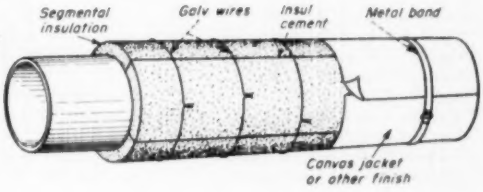
Single Layer, *upper sketch,* is applied by butting sections closely and banding canvas jacket or other finish over insulation. Insulation must be kept far enough from flange to permit bolt removal

Double Layer, *lower sketch,* is applied by wiring first layer in place with separate loops spaced on about 8-in. centers. Omit canvas jacket between layers. Second layer is banded in place over first, using canvas jacket or other finish. Never leave any sharp projections on bands. They may cut finish

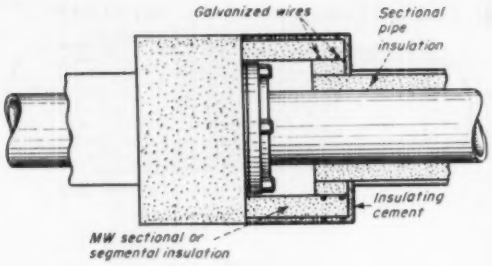


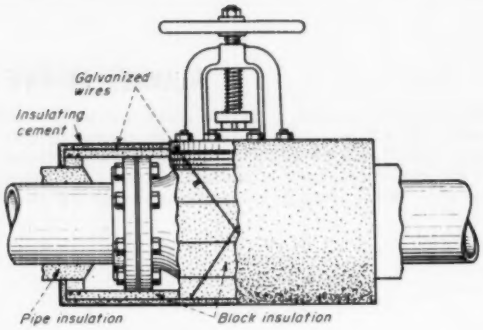
SEGMENTAL PIPE COVERING

To get a good job, butt segments tightly before wiring in place with 16-gage galvanized wire spaced on about 8-in. centers. Use insulating cement in joints where needed. Bend over ends of wires and press into insulation. Finish with canvas jacket or other material and band with metal



For more insulation facts, turn page ▸





MOLDED-TYPE FOR COUPLINGS

You can use molded-type pipe insulation to insulate flanged couplings. Wire rings of sectional pipe covering 1½ to 2 in. wide on each side of the flange. Rings should have an OD greater than flange diameter. Band a piece of sectional pipe insulation in place over flange and rings. Finish with insulating cement or other material

BLOCKS ON FITTINGS

For large fittings use blocks that are ¼ in. less thick than the insulation on the adjacent piping. Fit carefully and wire securely in place with 16-gage galvanized wire. Then apply ¼-in. coat of insulating cement over blocks, troweling it well into all cracks between adjacent blocks. Other specified finishes may be used in place of insulating cement

Facts to Remember About Mineral Wool

Mineral wool is rock, slag or glass processed from molten to fibrous form. It is used in loose, granulated, felt, blanket, batt, block, board, molded and blanket (for pipes) form. Insulating cement is a dry mixture of mineral wool and other ingredients which when mixed with water can be troweled.

Commercial mineral wool is classed according to maximum temperature limits as:

Class	Temperature, F
A	600
B	1000
C	1200
D	1600
E	1800

The K Factor

The K value (Btu transmitted per hr per sq ft for a temperature gradient of 1 deg F per inch of thickness) varies from a low of 0.35 for batts at 200-F mean temperature to a high of 0.80 for insulating cement at a mean temperature of 400 F. Other forms fall in between these values. Density and physical properties depend on form and intended use.

For low temperatures K doesn't exceed value of 0.28 at 50-F mean temperature. Minimum thicknesses recommended for refrigerated spaces vary from 3 to 4 in. at 35 F to 12 in. or more at –10 F and below—*Commercial Standard CS105-48.*

Pipe Insulation

Molded-type pipe insulation comes in 1, 1½, 2, 2½, 3 and 4-in. thicknesses for all nominal pipe sizes. It is also available in "standard" and "double standard" thicknesses, table below:

Insulation Thickness: Standard (S) And Double Standard (DS)

Pipe size, nominal	*S*	*DS*
1/2 to 1 1/2	7/8	1 3/4
2 to 3 1/2	1 1/32	2 1/16
4 to 6	1 1/8	2 1/4
8 & 10	1 1/4	2 1/2
12 and over	1 1/2	3

Flat-Surface Insulations

Loose or granulated mineral wool for use at temperatures up to 1600 F is packaged in bags containing up to 40 lb each. Felts suitable for use up to 600 F come in sizes 1 to 4 in. thick x 24 in. wide, 30 or 48 in. long. Blankets suitable up to 1200 F come in 1 to 6-in. thicknesses x 24 in. wide, 4 or 8 ft long.

Industrial batts usable up to 1200 F are 1 to 4 in. thick x 24 in. wide, 4 ft long. Blocks are 1 to 4 in. thick x 6 or 12 in. wide, 18 or 36 in. long. 1 to 3-in.-thick boards, 12 to 36 in. wide, 3 or 4 ft long, are also standard. These blocks and boards can be used at temperatures up to 1200 F, according to class.

Insulating cement can be used at any temperature up to 1800 F. It is packaged in 50 lb bags. Minimum coverage is 45 sq ft, 1 in. thick, per 100 lb of dry cement.

Application

Here are a few characteristics important in using mineral wool:

Loose, Granulated and Batt Wool: Low in cost but need structural retention and protective finish such as a metal shell or masonry.

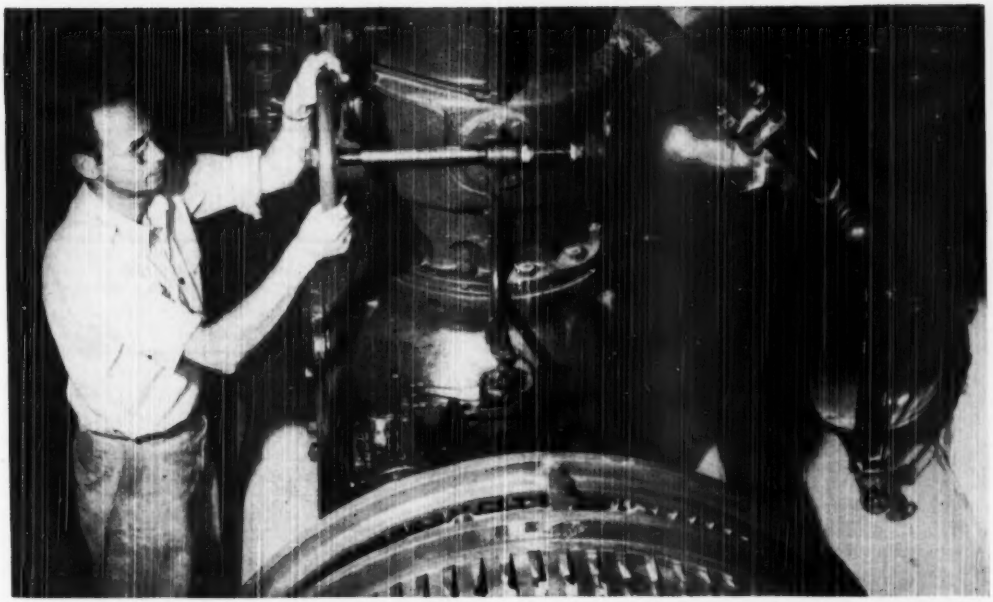
Felts and Blankets: Low in cost, good thermal value with some rigidity. Not designed for load-bearing service.

Blocks and Boards: Rigid with good compressive strength. Can be installed where operators may have to cross insulation for maintenance, etc.

Blanket-Type Pipe Insulation: Flexible with good thermal properties.

Molded-Type Pipe Insulation: Rigid and strong, it is easy to install.

Insulating Cement: Good adhesive properties and easy to spread over valves and fittings. It can be re-used.



REFRIGERANT-PIPING size can make or break a system. For maximum output, compressor piping must be of sufficient size to prevent excessive pressure drops in high and low sides of system. Small pressure drops give the best economy

Size Refrigerant Lines for Low Cost

Use a pipe too large for the job and you'll increase first cost. But install too small a line, in an attempt to save money, and you'll waste power every day the plant runs. Here are the facts for choosing pipe size that will give best economy in your refrigerating plant

► COST OF SUCTION and discharge piping is usually a small part of the total outlay for your refrigerating plant. Yet undersized piping can increase your annual operating costs from 5 to 30%, or more, depending on how much pressure drop occurs in the system.

When you select pipe sizes you must solve an economic problem. To do this, low initial piping cost, high operating costs and large pressure drop are compared with high first cost for piping, low operating cost and small pressure drop. Aim of this comparison is not use of largest pipe that can be connected to compressor, but a middle-of-the-road design: use of a pipe size that causes only moderate pressure drop and costs but slightly more than undersized pipe.

Pressure Drops. Fig. 1 shows a typical compression system and Fig. 2 is a plot of the refrigeration cycle on a skeleton Mollier chart.

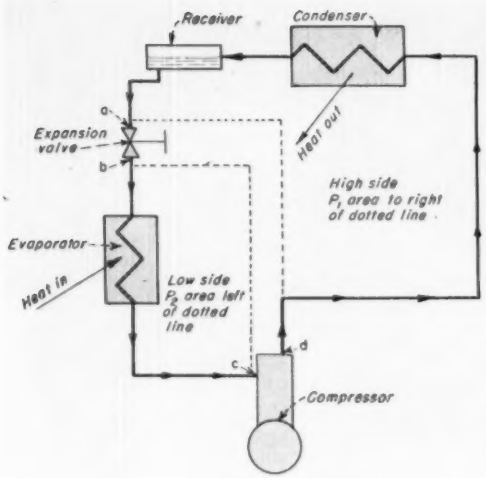
In the ideal cycle, Fig. 2A, saturated liquid leaves receiver and enters expansion valve at a. Between a and b, temperature of liquid decreases as it partially vaporizes during passage through the expansion valve. Since this is a throttling process, enthalpy (heat content) remains constant. So we use a straight line, ab, to show it. On entering the evaporator, the liquid is at saturation temperature corresponding to lower pressure P_2.

In the evaporator the refrigerant absorbs heat and enters the compressor at c as a saturated vapor. Compression takes place between c and d, desuperheating and condensation between d and a. Refrigerant enters and leaves the condenser at saturation pressure P_1, corresponding to the condensing temperature.

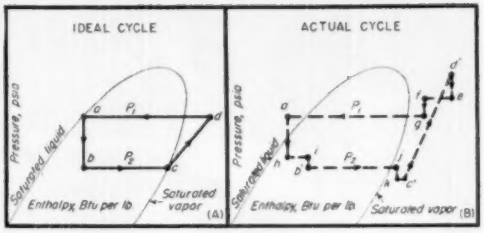
Excessive pressure drop in suction and discharge piping causes system performance to vary markedly from the ideal. Suction-vapor superheating, caused by pipe friction and heat gain from atmosphere, shifts compressor inlet point c, to right, c', Fig. 2B. Besides compressor must operate at a lower suction pressure to make vapor flow against greater resistance between evaporator and compressor inlet.

Low suction pressure causes poor operating economy. Not only that, compressor capacity is reduced. This capacity reduction is one of the principal disadvantages of high resistance in suction lines.

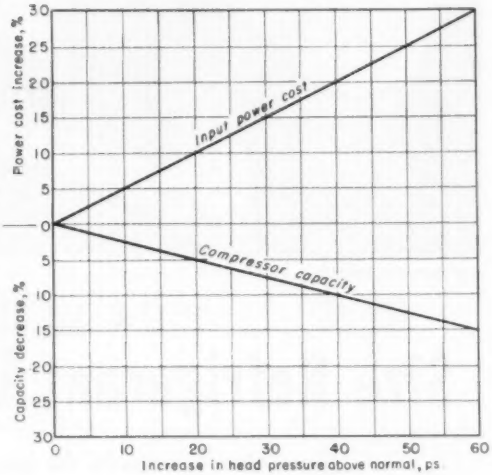
When discharge piping resistance is low, say 1 psi drop, you can usually



1 Typical compression system shows various points at which refrigerant state must be considered when sizing piping



2 *(A)* Ideal refrigeration cycle on the Mollier chart. *(B)* Actual cycle with friction and excessive pressure losses



3 Ammonia compressor's power input increases rapidly, while its capacity decreases as discharge pressure is increased

assume discharge pressure equal to condensing pressure. Then compression takes place along some curve like *cd*, Fig. 2A. But when discharge piping resistance is high, 10-psi drop, or more, compressor must operate against sum of condensing pressure and line resistance.

Raising the discharge pressure increases work of compression and reduces compressor capacity. Power input increases. Compressor then operates along some curve like *c'd'*, Fig. 2B.

Other variations from ideal are: Throttling in discharge valve occurs from *d'* to *e*, pressure loss in discharge pipe from *f* to *g*. Suction line friction causes pressure drop *ib'* and valve wiredrawing drop *jk*. Heat gain during entrance to evaporator occurs from *h* to *i*, compressor, *k* to *c'*.

Suction Line. To show how pressure loss affects operating conditions, suppose we have a 2-cyl vertical ammonia compressor operating with 5.5-F evaporator temperature and 20-psig evaporator pressure. Compressor suction pressure is 19.6 psig, condensing pressure 155 psig. A $20 - 19.6 = 0.4$ psi pressure loss takes place between evaporator and compressor. With proper-sized piping, compressor performance is as shown in first column of Table I.

Suppose, though, our suction line is long and undersized to save on first cost. Pressure loss between evaporator and compressor increases, say to 4.3 psi. If evaporator pressure and temperature are to remain constant, compressor must operate at a suction pressure of $20.0 - 4.3 = 15.7$ psig. Performance is shown in second column of Table I.

A look shows you that with increased resistance compressor capacity falls 36 tons, or about 13.5% below rating, but power input drops only 2.8%. Where load was closely figured, this reduction in capacity seriously affects process served by compressor. First column of Table I shows that compressor selected has adequate capacity for maximum load when suction piping is sized for 0.4-psi drop.

Discharge Line. Now let's suppose compressor has properly sized suction piping but undersized discharge piping. With a 30-psi drop between compressor and condenser, capacity and power requirements stack up as in lower half of Table I. There's a 3.8% reduction in capacity and an 11.8% increase in power input. From this you can easily see the importance of properly sized discharge piping.

Fig. 3 shows effect of increased discharge pressure on ammonia compressor capacity and power requirements. These are general curves giving approximate values for usual compressors.

Remedies. Undersized piping selected during planning stage often is not discovered until after system is in operation. Then replacement of good, tight piping is usually avoided because it's expensive and interrupts plant operation. Usual alternative is to install a smaller machine to carry that part of load which large machine cannot handle.

Such an installation is, however, economically unsound because: (1) First cost of small compressor and related equipment is usually several times that of proper-sized suction and discharge piping for large unit. (2) Annual costs are now composed of amortization, power, maintenance and labor for *two*

units instead of one. You needn't set up an analysis of these costs; experience shows that using two compressors for a job one could do is always wasteful.

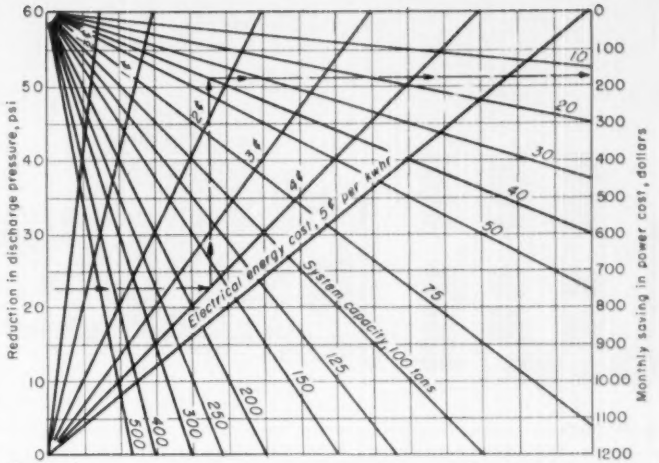
Power Costs. Fig. 4 shows money you save in operating costs by reducing discharge pressure of electrically driven ammonia compressors. For instance, with a 22.5-psi reduction in discharge pressure, a current cost of 4c per kwhr and a 40-ton compressor, monthly power-cost saving is about $180, or about $2160 a year. Savings of this amount easily pay for larger discharge piping in a few months. Savings with other types of drives will approximate values for electricity, according to relative cost of energy.

Remember, pressure losses we assume in this article are slightly greater than those usually found in actual plants. We do this to illustrate the point. But there are cases on record which show pressure losses greater than we assume. And although we talk about ammonia systems, effects are similar with other refrigerants like Freon-12 and methyl chloride.

Fig. 4 can also be used for plants in which air and other noncondensables have raised head pressure. Savings obtainable are found in same way.

Pipe Size. Refrigerant-pipe total resistance depends on compressor tonnage, vapor velocity, pipe length, number of bends, and pipe size. Experience shows that limiting the velocity to values within the ranges in Table II is usually safe. Of course, special conditions may warrant use of either higher or lower velocities, but ranges given apply in most cases. Usual total-pressure drops permissible in suction and discharge piping are also tabulated. With allowable velocity known, pipe size can be determined by standard pressure-loss equations, quantity of refrigerant circulated, and allowable total-pressure loss. Short, straight suction and discharge lines are best from standpoint of minimum pressure loss. Where total equivalent length of piping exceeds 100 ft or so, use extreme care in sizing piping. Selecting a size larger than indicated by calculation is often advisable. Excessively long suction lines not only have high resistance, but they also absorb more heat from atmosphere than short ones.

Compressor manufacturers and plant operators rely on the designer to size system piping properly. Manufacturer must depend on the designer because prediction of run-length and number of bends is difficult until after layout has been studied. To do justice to manufacturer and operator, designers should avoid the false economy of installing undersized piping to reduce investment costs during construction.



4 Monthly power-cost savings with reduced head pressure. Chart is based on 24-hr-a-day operation, 30-day month. For other than 24-hr 30-day operation, multiply cost from chart by percent daily and monthly operation to obtain savings possible

I—EFFECTS OF VARIATION IN SUCTION AND DISCHARGE PRESSURE

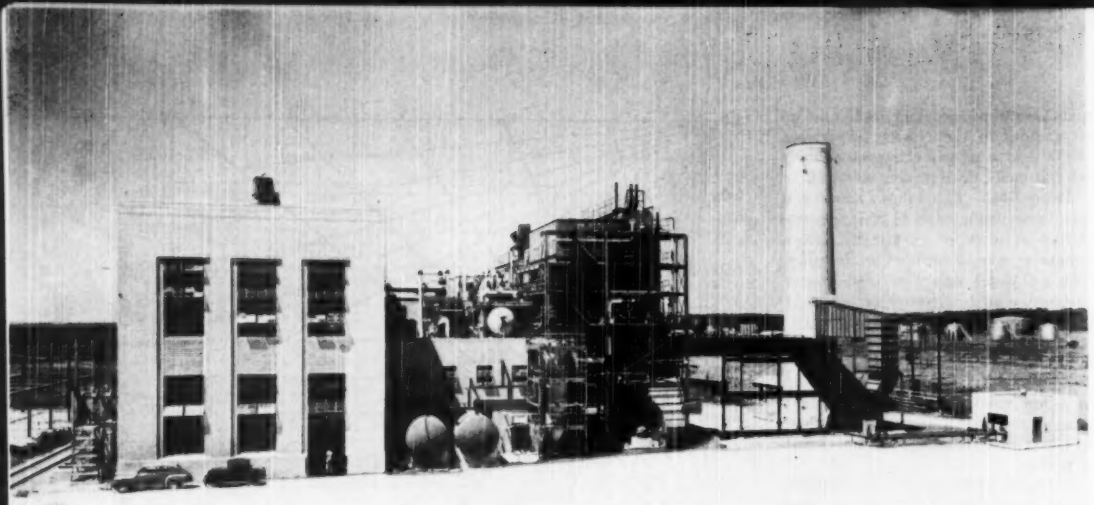
Compressor Rating

Capacity, 266 tons; drive, 350 hp, 180 rpm
Suction pressure—20 psig; discharge pressure—155 psig
Compressor hp, 325; piston displacement, 10,179 cu in.

		Pressure loss: Low	*High*
Plant Operating Conditions	Load, tons	260	260
	Compressor suction pressure, psig	19.6	15.7
	Evaporator suction pressure, psig	20.0	20.0
	Evaporator temperature, F	5.5	5.5
	Pressure loss, suction line, psi	0.4	4.3
	Condenser pressure, psig	155	155
	Compressor capacity, tons	263	230
	Hp input	324.5	316
	Hp per ton	1.23	1.37
	Capacity reduction, %	1.1	13.5
	Power reduction, %	0.15	2.8
Discharge-Pressure Variation	Compressor suction pressure, psig	19.6	19.6
	Evaporator suction pressure, psig	20.0	20.0
	Evaporator temperature, F	5.5	5.5
	Pressure loss in discharge line, psi	4	30
	Condenser pressure, psig	155	155
	Compressor discharge pressure, psig	159	185
	Compressor capacity, tons	262.6	253
	Hp input	330	362.7
	Hp per ton	1.26	1.43
	Capacity reduction, %	0.15	3.8
	Power increase, %	1.7	11.8

II—VELOCITIES AND PRESSURE LOSSES FOR VARIOUS REFRIGERANTS

Refrigerant	*Suction-line velocity, ft per min*	*Discharge-line velocity, ft per min*	*Suction-line pressure drop, psi*	*Discharge-line pressure drop, psi*
Ammonia	2000 to 5000	4000 to 6000	1 to 1½	1 to 4
Freon-12	1500 to 4000	2000 to 3500	1 to 3	3 to 5
Methyl chloride	1500 to 4000	2000 to 5000	1 to 3	3 to 5
Carbon dioxide	1000 to 2500	1000 to 2000	1 to 2	1 to 3



LEON CREEK has enclosed turbine room, left, enclosed control room, center, with heaters on roof, condensate tanks and hot-process softener in foreground. Outdoor boiler with f-d fan, breeching, i-d fan, stack, gas-metering house at right

Leon Creek: Low-Cost Semi-Outdoor

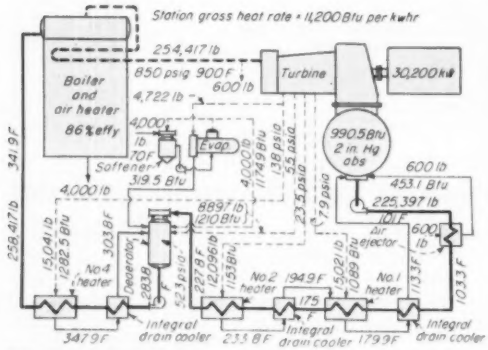
Plant for City of San Antonio, Texas, beats erection schedule by nine months. Completely centralized control room also houses valves for manual control of fuel gas and feedwater

COST OF COMPLETED PLANT

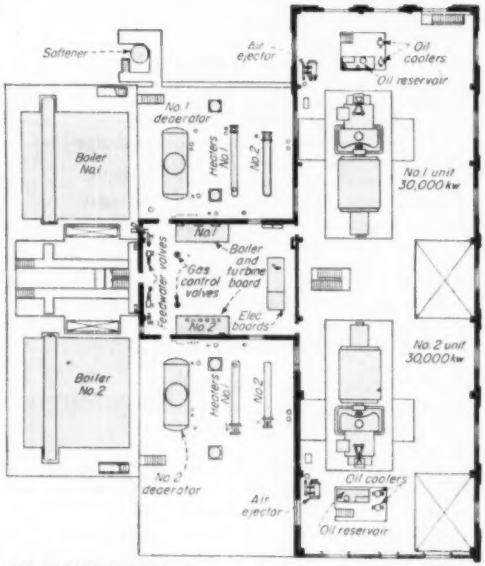
(One Unit)

Includes all engineering, construction overheads and fees

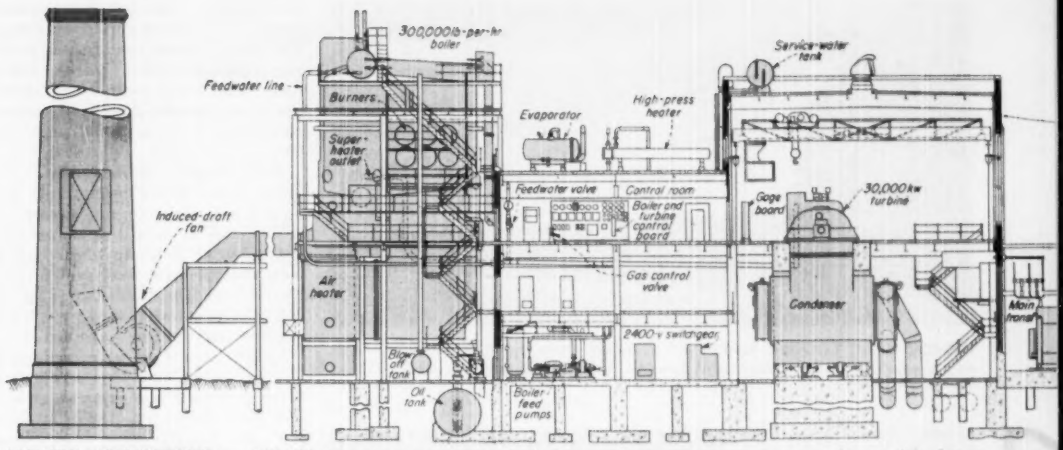
Land (prorated)	$ 11,333
Power-plant structures, miscellaneous equipment	596,836
Boiler-plant equipment and auxiliaries	968,170
Turbine-generator and auxiliaries	1,356,900
Substation and control	261,778
Auxiliary electrical equipment and control	235,028
Total investment	$3,430,045
Unit investment, per kw rated capacity	$114.33



STATION HEAT BALANCE employs four turbine bleed openings, three closed heaters with integral drain coolers, deaerator



ONE CONTROL ROOM, one stack serve two units. Roof slab over boiler burner fronts protects operator from the weather



UNIT-TYPE ARRANGEMENT has 300,000-lb-per-hr steam generator feeding 30,000-kw turbine unit at 850 psig, 900 F. Gas-fired boiler with oil standby is arranged for possible future conversion to lignite firing, with installation of precipitator

Station

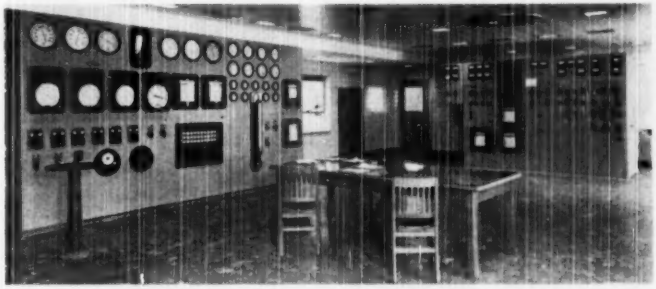
By **JOHN H HOCHULI**, *Gibbs & Hill, Inc*

► WHEN GROUND WAS initially broken February 23, 1948, Leon Creek Unit No. 1 was scheduled to be completed in the Spring of 1950. By close cooperation of the City's personnel, the manufacturers, engineers and construction forces the machine went on the line August 1, 1949, nine months earlier than anticipated. This was done on a 40-hour construction week with a minimum of overtime. Final plant cost averaged out at $114.33 per kw of rated capacity.

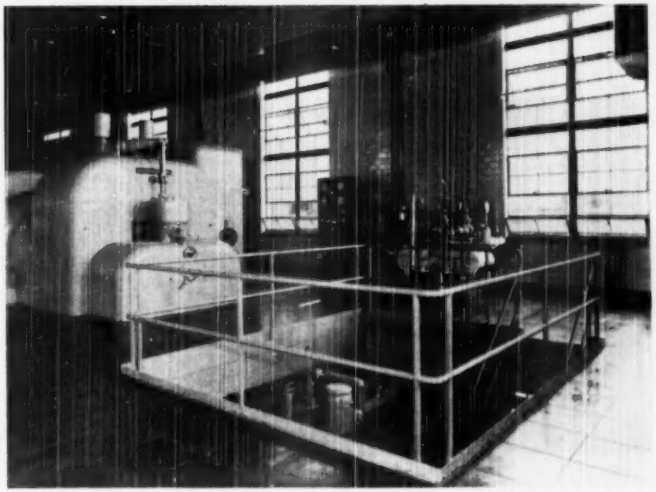
Main Equipment. Semi-outdoor construction of Leon Creek houses turbine-generator unit and main auxiliary machinery and places boiler, fans, hot-process softener, feedwater heaters, evaporators, cooling tower, circulating pumps, transformers and switching station outdoors. Ultimate plant will have four 300,000-lb-per-hr boilers individually feeding four 30,000-kw preferred-standard turbine-generators at 850 psig, 900 F.

Each unit will have its own induced-draft cooling tower capable of cooling 30,000 gpm of water from 105.5 F to 90 F at a wet-bulb of 76.5 F. Two vertical circulating pumps at the tower supply each condenser. One pump alone carries night load with increased efficiency.

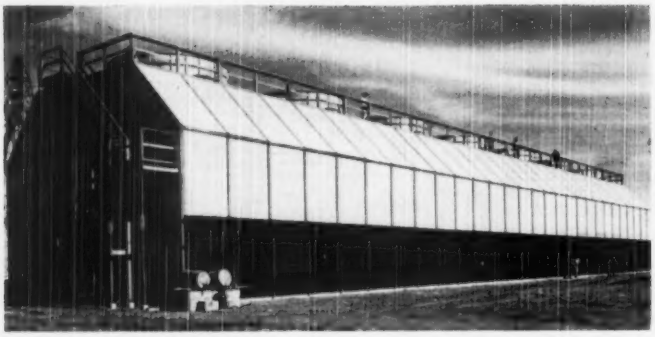
Each pair of units will have one stack. A centralized control room will be provided for each pair of units, making



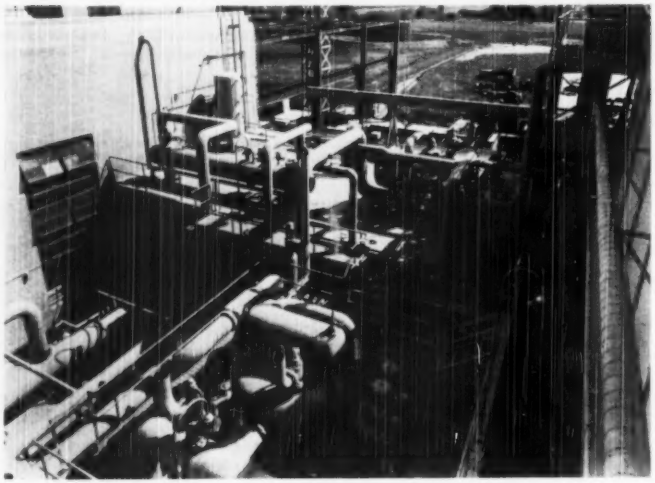
CENTRALIZED CONTROL ROOM has boiler and turbine board unit No. 1 at the left, with hand-controlled gas valve. Electrical control board stands at right



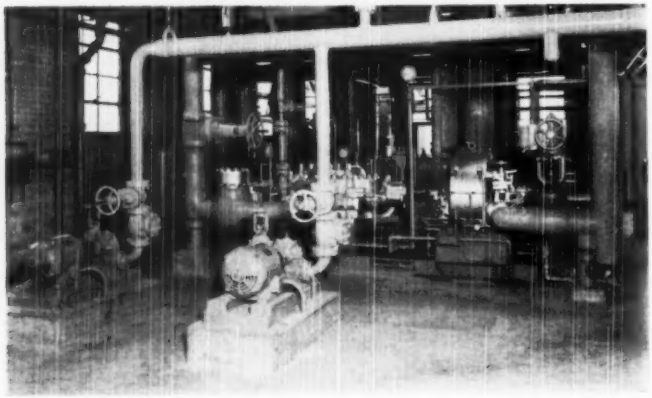
TURBINE-ROOM ARRANGEMENT aids operation and maintenance. Turbine oiling system located in shallow well. Steam-jet air ejector stands next to turbine board



INDUCED-DRAFT COOLING TOWER with seven cells has 30,000-gpm capacity. Fans and drives supported on aluminum beams to eliminate painting, sheathed for looks



ROOF EQUIPMENT includes feedwater closed heaters, evaporator with its heaters, deaerating heaters. Steelwork for Unit No. 2 turbine room appears in back center



AUXILIARY BAY at ground level houses service pumps in foreground, turbine-driven boiler-feed pump directly behind, motor-driven pumps, air compressor in back

two separate rooms for the completed station. These are on turbine-operating-floor level. Control room houses boiler and turbine-generator boards, transmission-line switch controls and instruments and also control valves for manual operation of fuel gas, fuel oil and feedwater.

Water Supply. Three artesian wells furnish water to the plant. Wells are piped together so water can be supplied by any or all to circulating and service-water systems. Wells are about 1300 ft deep and develop a head of 5 psig at ground level. This eliminates pumping. A float valve at each cooling-tower basin regulates makeup flow as needed.

Service water from boiler-feed-pump bearing cooling and from compressor bearings returns to a sump at ground level at northwest end of auxiliary bay. From here water is pumped to cooling-tower basins. In this way best utilization is made of scarce water. Chemical treatment of sump water before it returns to tower basins takes care of entire circulating-water system.

Circulating-water-pump discharges are fitted with butterfly valves. These close when pumps shut down. Pumps have enough capacity to furnish water for turbine auxiliaries, such as, turbine oil coolers, gland-seal oil cooler, gland-seal vacuum pump, and generator hydrogen coolers. This cooling water flows from circulating pipe leading to condenser and discharges to circulating pipe leaving condenser and going to cooling tower.

Steam Generator. The integral-furnace-type boiler has a maximum continuous capacity of 300,000 lb per hr. Design pressure is 1000 psig. Under control of an attemperator, it will deliver steam at 900 F from outputs of 180,000 to 300,000 lb per hr. Economizer surface is not included. Boiler design calls for feedwater at 346 F at full rating.

Water-cooled furnace primarily burns natural gas with a maximum heat release of 31,500 Btu per cu ft per hr. Bunker C oil as standby fuel burns with a heat release of 30,200 Btu per cu ft per hr. A single 90,000-cfm forced-draft fan directly coupled to a 250-hp motor feeds air to the furnace through a tubular air heater. A single induced-draft fan near the stack handles 163,000 cfm of 425-F flue gas. A directly coupled 450-hp motor drives the fan. These fans can be seen in view at top of page 94.

Boiler installation allows for possible future conversion to lignite burning. High setting elevation permits later installation of a hopper beneath furnace, together with pulverizers. Long breeching between air-heater outlet and i-d fan allows for future precipitators.

Heat Balance. All four turbine bleed points heat feedwater and evaporate

PRINCIPAL POWER-PLANT EQUIPMENT

Leon Creek, City Public Service Board, San Antonio, Texas

STEAM-GENERATING EQUIPMENT:

Boiler, 1	Babcock & Wilcox Co
Integral-furnace type, 300,000 lb per hr max continuous rating, 850 psig, 900 F. Boiler, 17,996 sq ft; waterwalls, 3200 sq ft; superheater, 5180 sq ft; furnace volume, 13,200 cu ft; heat release, 31,500 Btu per hr per cu ft. Superheat controlled from 180,000 to 300,000 lb per hr flows. Gas and oil fired	
Air heater, 1	Babcock & Wilcox Co
Tubular, 49,260 sq ft, 2 gas passes, 1 air pass	
Forced-draft fan, 1	Sturtevant Div, Westinghouse Electric Corp
90,000 cfm, direct coupled, 1180 rpm, 13-in. static pressure, 125 F	
Forced-draft fan drive, 1	Westinghouse Electric Corp
250-hp, direct-coupled, squirrel-cage, 1200-rpm, drip-proof, 2300-v, 3-phase, 60-cycle motor	
Induced-draft fan, 1	Sturtevant Div, Westinghouse Electric Corp
163,000 cfm, 12.8-in. static pressure, 425 F, 700 rpm	
Induced-draft fan drive, 1	Westinghouse Electric Corp
450-hp, direct-coupled, squirrel-cage, 720-rpm, 2300-v, 3-phase, 60-cycle motor	
Fuel-oil handling system	A M Lockett & Co
29,000 lb per hr of bunker-C oil	
Oil heater, 1	Griscom-Russell Co
8-pass, straight-tube, heat from 90 to 220 F	
Fuel-oil pump, 1	Quimby Pump Div, H K Porter Co
29,000 lb per hr, 200 psig	
Fuel-oil pump drive, 1	Westinghouse Electric Corp
15-hp, 1170-rpm, splashproof, 220-v, 3-phase, 60-cycle motor	
Water column, 1, bi-color	Diamond Power Specialty Corp
Non-return, stop-check, blowoff valves	Edward Valves, Inc
Safety valves (Consolidated)	Manning, Maxwell & Moore, Inc
Brick chimney, 1	The M W Kellogg Co
Chemical feed valves	Wm Powell Co
Chemical feeder	Infilco, Inc
Feedwater control valve	Bailey Meter Co
Combustion control system	Bailey Meter Co
Oil storage tank, 20,000 bbl	Chicago Bridge & Iron Co
Storage-tank oil heater	Struthers Wells Corp

POWER GENERATING EQUIPMENT:

Turbine, 1	Westinghouse Electric Corp
30,000-kw, AIEE-ASME preferred standard, 850-psig, 900-F, single-casing, impulse-reaction, 3600 rpm	
Generator, 1	Westinghouse Electric Corp
35,295-kva, 0.85-pf, 13,800-v, 3-phase, 60-cycle, hydrogen-cooled; 145-kw 250-v direct-connected exciter, 2.5-kw 250-v pilot exciter	
Condenser, 1	Westinghouse Electric Corp
27,500-sq-ft, radial-flow, 2-pass; non-divided water boxes, 2500-gal deaerating storage hotwell, inhibited-admiralty tubes, munta-metal tube sheets	
Air ejector, 1	Westinghouse Electric Corp
Twin-element, 2-stage; 510 lb per hr, 850 psig, 900 F, 8.5 cfm free air	
Circulating water pumps, 2	Westinghouse Electric Corp
15,000-gpm mixed-flow impeller; 3-stage, 53-ft head	
Circulating pump drives, 2	Westinghouse Electric Corp
300-hp squirrel-cage, 585-rpm, 2300-v, 3-phase, 60-cycle motor	
Cooling tower, 1	C H Wheeler Manufacturing Co
30,000-gpm, induced-draft, 7-cell; 41 ft 6 in.x197 ft, 105 to 90 F with 76.5 F wet-bulb temp; 4 blades per fan, 204-in. dia, 219 rpm; redwood filling, transite siding	
Cooling-tower-fan drives, 7	Westinghouse Electric Corp
40-hp, 1800-rpm, 3-phase, 60-cycle motors	
Cooling-tower-fan gear units, 7	Cleveland Worm & Gear Co
Circulating-water piping	Grinnell Co
Butterfly valves, 2	Henry Pratt Co
24-in., operated by Limitorque motors, 440-v, 3-phase, 60-cycle	

FEEDWATER SYSTEM:

Condensate pumps, 2	Westinghouse Electric Corp
550-gpm, 310-ft total head	
Condensate-pump drives, 2	Westinghouse Electric Corp
75-hp squirrel-cage, 440-v, 3-phase, 60-cycle motor	
Boiler-feed pumps, 2	Ingersoll-Rand Co
713-gpm, 7-stage, 3550-rpm; 2545-ft head, 288 F	
Boiler-feed-pump motor, 1	Westinghouse Electric Corp
600-hp, squirrel-cage, 2300-v, 3-phase, 60-cycle, 3550-rpm	
Boiler-feed-pump turbine, 1	Terry Steam Turbine Co
600-hp, 3550-rpm; 850-psig, 900-F throttle, 40-psig exhaust to deaerator	
Closed feedwater heaters, 3	Westinghouse Electric Corp
No. 1: 1100-sq-ft, horizontal, U-tube; integral drain cooler	
No. 2: 805-sq-ft, horizontal, U-tube; integral drain cooler	
No. 4: 955-sq-ft, horizontal, U-tube, integral drain cooler	
Deaerating heater, 1	Cochrane Corp
300,000-lb-per-hr, tray-type; 52 psig, Cu-Ni tubes, 0.005 cc O_2 per liter, 1000 cu ft storage	
Evaporator, 1	Westinghouse Electric Corp
230-sq-ft, submerged-bundle, thermal-descaling; 8000 lb vapor at 40 psig	
Turbine bleeder and non-return valves	Atwood & Morrill Co
Feedwater treating	Belco Industrial Equip Div, Bogue Electric Co
Hot-process lime-soda-ash softener; deaerates 20,000 lb per hr at 227 F	

ELECTRICAL EQUIPMENT:

Main and auxiliary power transformers	Westinghouse Electric Corp
Outdoor oil circuit breakers	Westinghouse Electric Corp
Metal-clad switchgear	Westinghouse Electric Corp
Unit-type substations	Westinghouse Electric Corp
Control centers	Westinghouse Electric Corp
Insulated cable	The Kerite Co The Okonite Co
Lightning arresters	General Electric Co
Carrier-current equipment	Westinghouse Electric Corp
Bare stranded copper cable	General Cable Corp
Control battery	Standard Electric Co
Street-lighting cable	Anaconda Wire & Cable Co
Stranded and telephone cable	General Electric Co
Copper bus bars	American Brass Co
Insulators	Ohio Brass Co
Annunciator, 21 point	Auth Electric Co
Telephone equipment	Stromberg-Carlson Co
Battery charger	Raytheon Manufacturing Co
Induction heater	Electric Arc, Inc

MISCELLANEOUS EQUIPMENT:

Air compressor, 1	Ingersoll-Rand Co
General service; 294-cfm, 10x11-in., 100-psig, 300-rpm	
Air-compressor drive, 1	Westinghouse Electric Corp
50-hp, 1200-rpm, 440-v, 60-cycle 3-phase motor	
Air compressor, 1	Ingersoll-Rand Co
Instrument-service, 166-cfm, 8x9-in., 100-psig, 325-rpm	
Air-compressor drive, 1	Westinghouse Electric Corp
30-hp, 1800-rpm, 440-v, 3-phase, 60-cycle motor	
Pumps, 9	Worthington Pump & Machinery Corp
2 condensate makeup, 2 service water, 2 service-water return, 2 evaporator feed, 1 fuel-oil transfer	
Fire pumps	American-Marsh Pumps, Inc
Steam power piping	Grinnell Co
Miscellaneous tanks	Wyatt Metal and Boiler Works
Steel valves, h-p and l-p	Walworth Co
Pressure-reducing valves	Republic Flow Meters Co
Instrument and control valves	Manning, Maxwell & Moore, Inc
Steel check valves	Edward Valves, Inc
Pressure-reducing valve, 4-in	Fisher Governor Co
Bronze valves	Lunkenheimer Co
Pressure-reducing valves	Leslie Co
Rubber expansion joints	Moisson Packing & Rubber Co
Recorders and accessories	Leeds & Northrup Co
Industrial thermometers	Taylor Instrument Co's
Pressure gages	Crosby Steam Gage & Valve Co
Tank-level gage	Liquidometer Corp
Mercury switch controllers	The Mercoid Corp
Oil purifier	DeLaval Separator Co
Turbine oil tanks	Wyatt Metal & Boiler Works
Ball-float steam traps	Kieley & Mueller, Inc
Impulse traps	Yarnall-Waring Co
Anti-freeze valves	Wheaton Brass Works
Insulation	Johns-Manville, Inc
Turbine-room crane, 30-ton	Manning, Maxwell & Moore, Inc
Lubricated plug valve, 8-in.	Walworth Co
Air-conditioning equipment	Westinghouse Electric Corp
Safety valves	J E Lonergan Co
ENGINEERS AND CONSTRUCTORS	Gibbs & Hill, Inc

makeup. Heaters No. 1, 2 and 4 are closed with integral drain-cooling sections. Heater No. 3 is a deaerator of the tray type, using Cu-Ni tubes in the vent condenser. Designed for 52-psig operation, heater has 1000 cu ft of storage volume for condensate. Effluent condensate is guaranteed to show not more than 0.005 cc O_2 per liter.

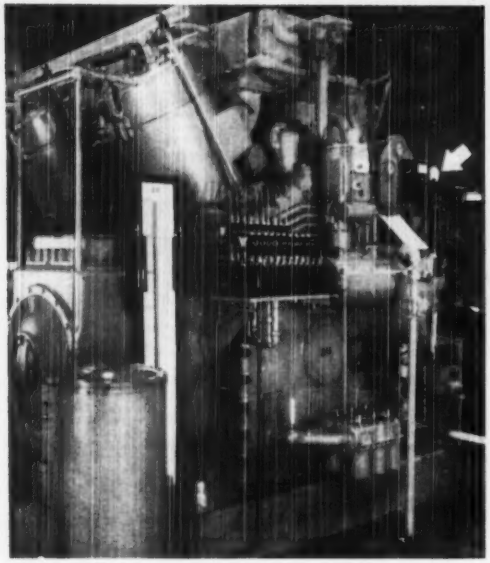
The 230-sq-ft evaporator has a submerged tube bundle. It delivers 8000 lb per hr of vapor at 40 psig to deaerator. Makeup to evaporator is preheated and softened.

Since initial operation in August 1949, unit has been producing 33,000 kw for 16 hr a day and about 16,000 kw during remaining 8 hr. It ties in with the City of San Antonio's Mission Road Plant, which has a total capacty of 83,500 kw. Leon Creek operates on base-load with Mission Road taking swings.

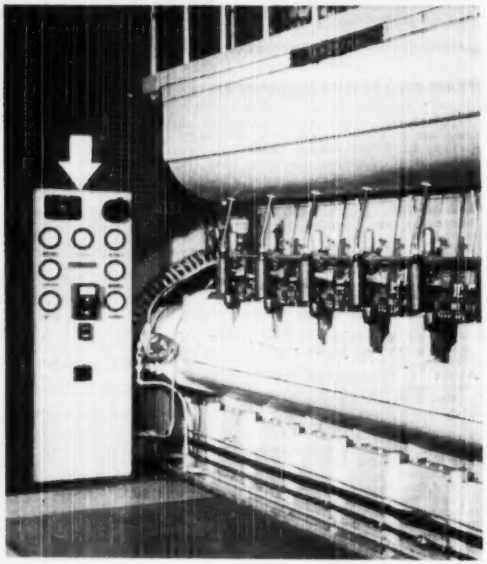
Both plants are operated by a board of trustees, known as the City Public Service Board. W P Napier is board chairman, V H Braunig general manager.

Unit No. 2 at Leon Creek is now under construction. Initial operation is scheduled for early 1951. Steel work and deaerator can be seen in background of roof-equipment picture on facing page.

EXHAUST PYROMETERS, ON ENGINE OR PANEL, CHECK COMBUSTION CONDITIONS



1 Exhaust pyrometer may be carried directly on the engine. Good practice calls for some form of shockproof mounting



2 In many plants, pyrometer indicator is on separate panel, along with other operating instruments and control units

Diesel Instruments and Controls: 2

By E J KATES
Consulting Engineer, New York, N. Y.

How to Check Exhaust and Intake

► You'll probably agree that nothing has more to do with good diesel or gas engine performance than the quality of combustion. Yet an "iron curtain" of cylinder walls and heads hides it from your view. So you turn to indirect means of checking it. That's where the exhaust comes in. Being the product of that hidden combustion, it bears traces of all that's happened in the cylinder. The trick is to spot these traces and learn how to interpret them. Fortunately, two characteristics of the exhaust tell you most of what you need to know—temperature and appearance. Let's look first at temperature.

Exhaust Temperature. When your engine is in topnotch mechanical condition and load is divided equally between cylinders, temperature readings should run about the same from cylinder to cylinder at any given load. When load is unbalanced, valves or piston rings aren't tight, nozzles are in poor condition or some other defect is present, temperatures shift. Such changes are your sign of trouble. Interpreted in the light of other clues to engine condition, they tell you where and what the trouble is.

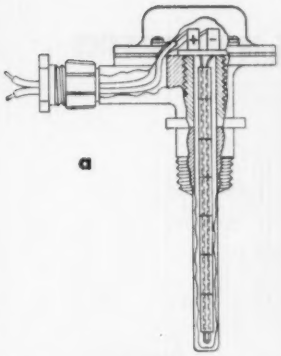
Convenient temperature measurement proves so important, in fact, that most modern engine plants are equipped with pyrometers. *All* plants should have them, except perhaps those so small that cost of temperature-measuring devices is high compared to cost of engines. In such cases, the simple "prod" pyrometer, needing no wiring or installation, is often used. Common temperature ranges for exhaust pyrometers are 0-1200 F for 4-cycle diesels and 0-1000 F for 2-cycle.

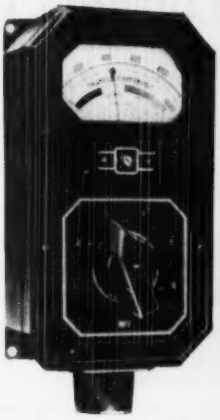
Pyrometers for diesel exhaust use are of the thermo-electric type. They are available in many forms and sizes, ruggedly constructed to stand vibration. For installation on the engine, Fig. 1, some form of shockproof mounting is usually supplied. Many engineers prefer to mount the pyrometer indicator with other instruments on a separate panel near the engine, Fig. 2.

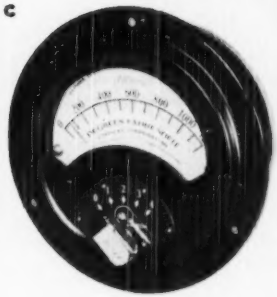
Pyrometer Principles. To select and apply pyrometers intelligently you need to know the basic thermo-electric principle involved. Let's review a bit, then. If two dissimilar substances in contact are heated, a voltage proportional to temperature develops. To get down to cases, let's make a closed circuit of two different metals. Then assume that temperature at one junction is different from that at the other. Current will flow and it will be proportional to temperature difference. Such a *thermocouple* is the basic element of a thermo-electric pyrometer. The two dissimilar metals generally used for exhaust thermocouples are iron and constantan (a copper-nickel alloy). Such a couple, for example, develops 19 millivolts if one junction is at 700 F and the other at 75 F.

Pyrometer Parts. A practical thermocouple element, Fig. 3a, consists of a pair of dissimilar wires welded together at the ends, enclosed in a protecting tube. This is the measuring, or *hot* junction. In usual engine practice, a thermocouple element mounts in the exhaust passage of each cylinder, Fig. 4. Extension wires connect these elements to a selector switch. By this means you can connect each element in turn to a single pyrometer indicator. This is a millivoltmeter (which

HERE ARE BASIC PYROMETER ELEMENTS AND CONNECTIONS







3 Thermocouple element *(a)* senses exhaust temperature, sends it to pyrometer indicators (*b* and c) to be measured. Selector switch permits single indicator to serve several thermocouples

4 Installation photo shows thermocouple elements in cylinder exhaust outlets, BX and conduit connections to meter

With the right instruments, properly installed, you can make sure you're maintaining good combustion conditions, key to efficient operation. Here are practical tips for doing the job

really measures current), having a scale graduated to read temperature directly. Fig. 3b and 3c show typical pyrometer indicators with built-in selector switches.

The other junction of dissimilar metals is the reference or *cold* junction. Its location depends on the kind of extension wires used. To see why, let's look into the important business of extension wires.

Extension Wires. If ordinary copper extension wires are used, the cold junction is the point of attachment to the thermocouple terminals. Being in different places, cold junctions will vary in temperature from cylinder to cylinder. And even for the same cylinder, temperature won't hold steady but will shift with changes in metal temperature and air surrounding it. Cold junctions at the thermocouple terminals are apt to be hard to get at and so temperature can't be measured readily. Hence readings, which depend on cold-junction temperature as well as hot, are subject to error. Even comparative readings between individual cylinders are apt to be untrustworthy.

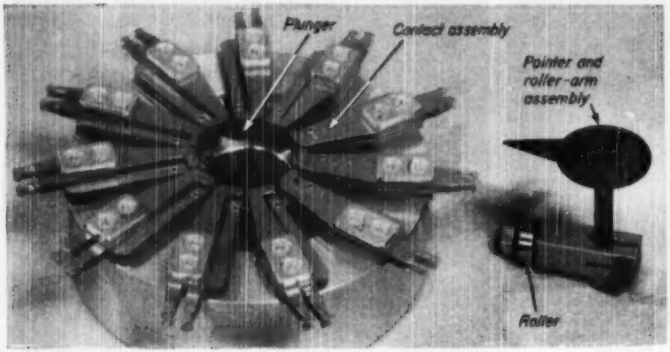
Alloy Extension Wires. If, on the other hand, extension wires are of same metals as thermocouple wires, cold junctions for all cylinders are transferred to the far ends of the extension wires at the terminals of the selector switch on the indicator. Being brought close together, they then have the same temperature. Thus *differences* in exhaust temperature between individual cylinders will show correctly without adjustment of the indicator. However, we still need to know what cold-junction temperature is, and compensate for it, before we can read on the indicator *actual* temperature of the hot junction.

Cold-Junction Adjustment. To make this adjustment, you put the selector switch in "off" position and adjust the indicator-needle setting to show actual cold-junction temperature as measured by an ordinary thermometer. Take this reading at selector-switch terminals for alloy extension wires; at thermocouple terminals for copper wires. Some pyrometer indicators are built to get rid of this need for manual adjustment. This is called "automatic cold-end compensation." A bimetallic spring or special resistance coil makes pointer setting follow changes in ambient temperature at indicator. Such instruments *must* be connected with alloy extension wires to get the benefits of this automatic compensation.

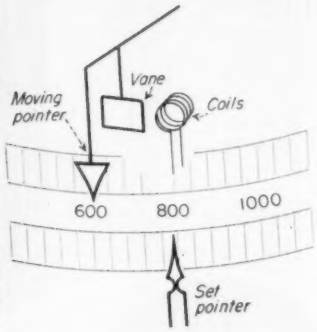
Circuit Resistance. Internal electrical resistance of pyrometer indicators should not be too low nor should resistance of connecting wires be too high. In other words, we want most of the total circuit resistance in the indicator. Here's why: Indicator temperature scale is calibrated in terms of *current flow* and assumes a certain resistance of the connecting wires. If the indicator has a low resistance while connecting wires have higher resistance than assumed, current flow is materially reduced and indicator reads too low. Common practice calls for No. 12 copper wire or No. 14 alloy wire.

Extension-Wire Length. If you use alloy extension wires, take care that they are of same length for each thermocouple, or use an indicator of high internal resistance. Iron-constantan wire has about 18 times the resistance of copper. No. 14 solid wire runs 0.089 ohms per combined ft of duplex wire at 70 F. Now if extension-wire lengths vary from 50 ft for shortest to 100 ft for longest, and indicator is calibrated for 75 ft, shortest wire will have 2.2 ohms less resistance than the calibration value. Longest wire will have 2.2 ohms more. If indicator has 25 ohms internal resistance, cylinder with short lead will read about 9% high and that with long

PYROMETERS CAN BE DESIGNED TO MONITOR CONTINUOUSLY, ACT IN EMERGENCIES



5 Elements of a continuous-monitoring selector switch: telephone-type relay contacts are closed by plungers pushed in sequence by roller arm driven at one rpm



6 Electronic circuit closing operates by detuning a vacuum-tube oscillator

lead about 9% low. In other words, if true thermocouple temperature is 600 on both cylinders, one would read under 550 F and the other over 650 F.

As internal resistance of the indicator increases, error from differences in extension-wire resistance becomes less, in same ratio. For instance, if a 500-ohm indicator had been used in the foregoing example, error would have been less than ½ of 1%.

Automatic Operation. In most cases, operator reads pyrometers at intervals. If reading indicates something is wrong, he takes action needed. This can be made automatic, saving operator's time and reducing possibilities of human failure. To do this, indicator must be fitted with some form of circuit-closing device to act when indicator needle reaches some preset point.

In a simple arrangement, the thermocouple is placed in the outlet of the exhaust manifold. Contact closes alarm circuit or stops engine when overload or other cause of high exhaust temperature develops. Better protection, however, comes from placing thermocouples in exhaust outlets of individual cylinders to detect overheating in any one of them, which might otherwise go unnoticed. Then the pyrometer indicator is fitted with a continuous rotating motor-driven selector switch to monitor each thermocouple in sequence.

Such a switch must be rugged and need no maintenance for long periods of continuous operation. One successful design, Fig. 5, employs telephone-type relay contacts closed by plungers pushed in sequence by a motor-driven roller arm. This turns at one rpm.

Circuit-closing device on pyrometer indicator must be well designed, since only small force is available. If direct contacts are used, they should make firm electrical contact without reducing accuracy, have quick make-and-break and adequate current-carrying capacity.

Electronic circuit-closing devices have no mechanical or electrical connection between the pyrometer indicator and the switch. Thus measuring element need not exert any effort to make switch operate and control a substantial amount of current. Some designs operate by affecting the tuning of a vacuum-tube oscillator circuit.

In Fig. 6, indicating pointer of pyrometer indicator carries a tiny metal vane whose path passes between two small coils. These coils form part of the electronic oscillator circuit and are mounted on an adjustable setting arm. When the indicating pointer, in response to rising temperature, moves vane between coils, shielding effect causes inductance of coils to drop sharply. This detunes the oscillator circuit and resulting change in vacuum-tube output operates a relay which closes the alarm or shutdown circuit.

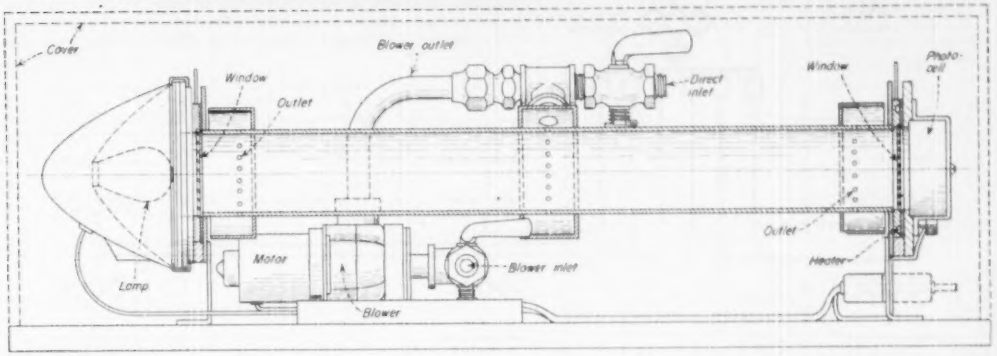
Exhaust Smoke. In addition to temperature, appearance of exhaust tells much about what is going on in the cylinders. A smoky exhaust indicates either incomplete combustion or excessive cylinder lubrication. Most engine operators rely on their eyes for checking exhaust appearance. But color of sky, quantity of exhaust, distance from stack and personal elements prevent strict accuracy. At night, of course, checking by eye is impossible.

To take the guess out of this business, a number of smokemeters have been developed. These can be used inside the engine room and give an objective indication of smoke density, independent of light conditions and individual judgment. One type operates on photoelectric principles.

Homemade Smokemeter. An easily built unit of this kind is shown in Fig. 8. It was developed in the diesel laboratories of the Pennsylvania State College and described in detail in POWER, Nov. 1941, p 800. The meter consists of an 18-in. tube, about 1¾ in. ID, with a glass window at each end. One end carries a 200-watt projector lamp and the other a photocell lightmeter like those used in photography. Amount of light entering the tube is adjusted by a diaphragm in front of the lamp or by a rheostat or shunt which changes light intensity by regulating voltage.

Copper tubing (¼ in. diam) carries exhaust to the smokemeter tube, which opens to the atmosphere through two rows of eight 1/16-in. holes. To measure smoke density, you scavenge the tube with air and adjust light to bring lightmeter reading to 50 foot candles. Then you admit engine exhaust for 30 sec and read the lightmeter. Ratio of lightmeter readings is in proportion to smoke density. If windows become obscured, or light source changes intensity, adjusting diaphragm or voltage to bring lightmeter reading back to 50 fc with clear air neutralizes the effect.

Commercial Form. Fig. 7 shows a commercial form of this instrument, with a number of refinements. Among these are: (1) A motor-driven blower scavenges the tube and forces in exhaust gas if there isn't enough pressure. (2) Hinged windows make cleaning easier. (3) Heater for window on photocell end prevents moisture from condensing on glass. (4) Shrouds on outside of tube around exhaust outlet holes



7 Commercial form of photocell smokemeter is similar in its principle to that of Fig. 8, but has refinements of construction to make it more convenient in use and insure high accuracy. It can be used on either 110-volt ac or 6-volt dc

prevent errors caused by free air entering holes due to outside draft (5) Meter scale, 0-100, reads smoke density directly. (6) Unit operates on either 110 v ac or 6 v dc.

Filtering Meter. Another type of smokemeter appears in Fig. 9. It operates on a different principle, making a record of the smoke sample on a paper disk. The method involves two steps: (1) A definite quantity of exhaust gas filters through a paper disk, pulled by an electrically driven vacuum pump (2) Soot collected on the filter paper is compared with ten shadings of a comparator scale.

Sampling unit consists of a shutoff valve, pressure regulator and filtering head. Pressure reducer ahead of filter disk and pressure-relief valve between disk and vacuum pump assure accurate control of flow rate, unaffected by engine back-pressure and variations in filter resistance. Then by timing, a given quantity of exhaust gas can be pulled through the filter disk each time.

Unique features of this instrument are (1) permanent record of smoke sample on paper disk which can be filed with engine test log (2) direct measurement of solid soot particles in the exhaust regardless of whether sample also contains liquid particles of unburned fuel or lubricating oil. Thus unit measures "hot" rather than "cold" smoke.

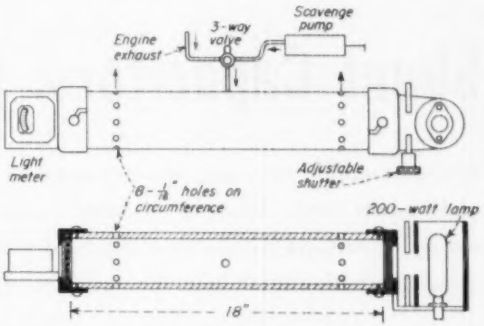
Exhaust Pressure. Average back-pressure on engine is easily measured with a U-tube filled with mercury. Readings are useful only for comparison, however, and hence value is limited. Such readings are sometimes taken on 2-cycle engines to see if exhaust piping and mufflers are heavily clogged. They seldom form part of routine internal-combustion-engine-plant operation.

Laboratory-type instruments are sometimes used at initial startup of plants to show *instantaneous* exhaust pressures at all parts of the cycle. This serves to check effects of pressure waves in piping on free discharge of exhaust gas from engine cylinders.

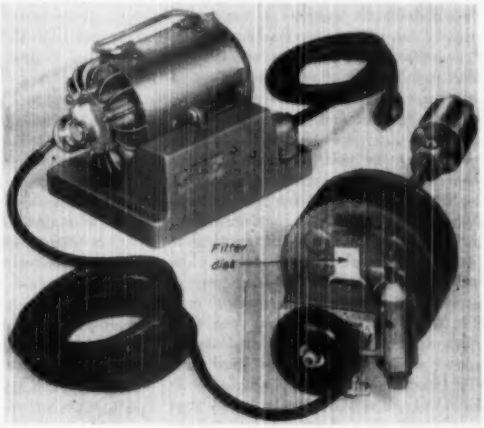
Valves are used in exhaust systems in two cases: (1) to bypass heat exchangers when heat isn't needed or when exchanger needs cleaning, and (2) to prevent backflow into engine opened for maintenance, in plants where several units exhaust into a common header.

It is important that such valves do not raise back pressure. Hence the gate type is commonly used. As pressures are low, operation is infrequent and slight leakage is permissible, simple construction can be employed. A typical

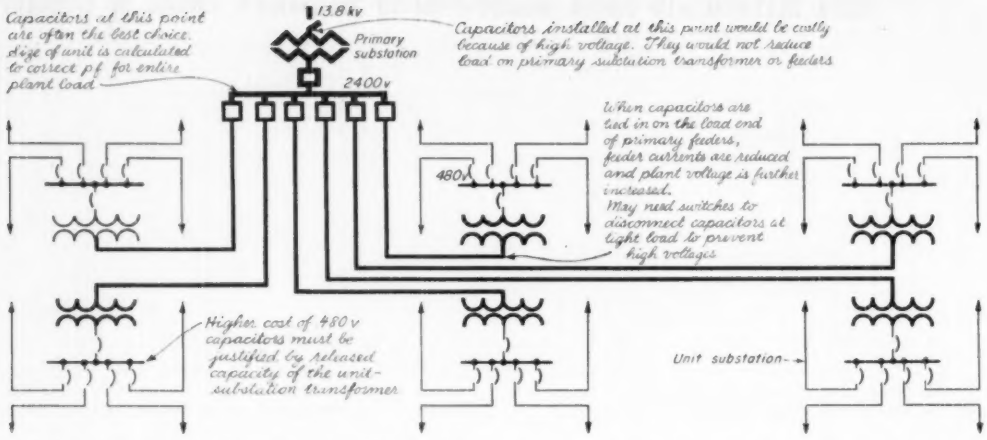
(*Continued on page* 162)



8 Simply made smokemeter employs photocell lightmeter like that used in photography, and an adjustable light source. Reading on exhaust gas is compared with reading on clean air



9 This smokemeter pulls a definite quantity of exhaust gas through a filter disk and collects sample for comparison with ten shadings of a comparator scale. Disks form a record


Capacitors at this point are often the best choice. Size of unit is calculated to correct pf for entire plant load
13.8 kv
Primary substation
2400 v
Capacitors installed at this point would be costly because of high voltage. They would not reduce load on primary substation transformer or feeders
When capacitors are tied in on the load end of primary feeders, feeder currents are reduced and plant voltage is further increased. May need switches to disconnect capacitors at light load to prevent high voltages
480 v
Higher cost of 480 v capacitors must be justified by released capacity of the unit-substation transformer
Unit substation

1 Outline of the possible points where capacitors might be installed on an industrial distribution system. Best point is often on primary bus. Installed cost goes up if units are tapped on high side of the incoming line or alongside load

Shunt Capacitors: Where to Put Them

Principal reason for using shunt capacitors is to improve plant power factor. When pf is raised it often means lower energy or demand charge from the local utility. But the big question is where to put them for maximum economical return.

By J E BARKLE JR and R N BELL
Central Station Engineers
Westinghouse Electric Corp

► Reduced loading of plant circuits and transformers from a capacitor installation applies only to that part of the distribution system on capacitor's supply side. Capacitor location also affects amount of voltage rise. Voltage rise equals product of capacitor's leading current and inductive reactance between capacitor and source. The closer the capacitors are placed to the load the larger the voltage rise. Maximum benefit comes from placing capacitors right alongside low-pf loads. But there's an economical angle to consider too.

Location. It isn't always practical to install capacitors in small banks close to individual loads. Combined cost of small banks often runs greater than cost of one large bank with same total capacity. Installation cost depends on space available, wiring required, etc, for either type bank. A single large bank of capacitors properly located may supply all a plant's capacitive kvar requirements. And it may take fewer capacitor units than would be used in a number of scattered small banks. Reason: diversity between the loads.

In addition, a number of small capacitor banks close to loads can produce excessively high voltages during light-load periods. This calls for automatic switching. Same amount of capacitive kvar in a large bank on main plant bus may produce only a nominal rise in light-load voltage. Hence automatic switching will not be needed.

Remember that 230-v capacitors cost more than twice as much per kvar as 460- or 2400-v capacitors. This is important in deciding location of capacitors in plants with 230-v distribution. All three factors—voltage rise, switching, cost—must be weighed against advantages of placing capacitors in small banks close to loads. This is brought out in Fig. 1.

Substation Bus. If principal reason for using capacitors is to improve plant pf, it often proves best and cheapest to connect them on plant substation bus. Then one bank provides necessary correction for entire plant. This type of installation accounts for largest number of capacitors used in industrial plants.

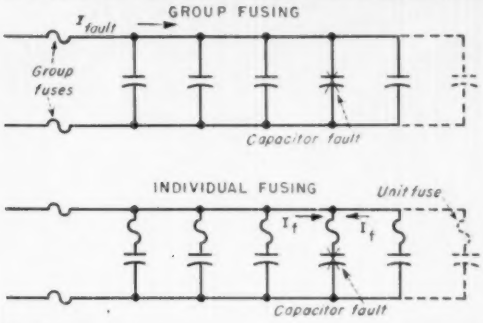
But such a group installation has no effect on loading of primary circuits, secondary substations, and 480-v plant-feeder circuits. Only primary substation transformer and supply system are relieved of supplying some lagging reactive current.

Of course it is possible to install a group-capacitor bank on high-voltage side of the primary substation. Table on p 104 shows relative cost of capacitors for several standard voltages. Here we see cost of capacitors runs somewhat higher if they are used on 13.8-kv side. Also, connecting a capacitor bank on supply side of substation does not relieve substation transformer of supplying any reactive load. These factors rule out a 13.8-kv installation in this particular case.

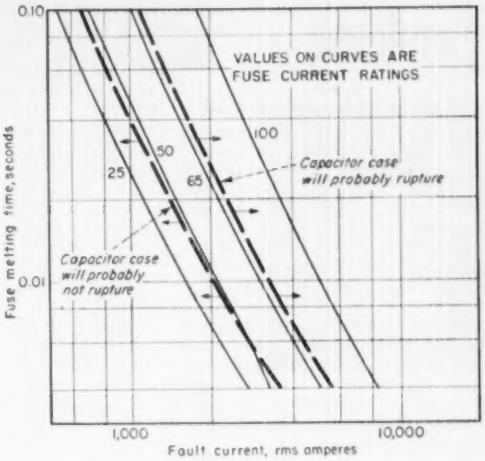
Primary Feeders. On the other hand, required capacitors for this plant can

Editor's Note: This article was prompted by the authors' AIEE paper "Application of Capacitors to Industrial Systems," presented at AIEE Industrial Power Conference, April 20, 1950, Pittsburgh.

CAPACITOR FUSE LOCATION DETERMINES DEGREE OF PROTECTION ON INTERNAL FAULT



2 Possibility of capacitor case rupturing after an internal fault is greater with group than with individual fusing



3 No fuse rated over 50 amp can be depended on to interrupt capacitor's internal-fault current before the case fails

be divided into several small banks and placed on primary feeders. Such an installation produces the same results as a group installation. And it has the added advantage of reducing current in primary feeders and providing a greater increase in plant voltage.

In many plants there is a high diversity between loads on primary feeders. If so, needed capacitor kvar can probably be put in a single-group at primary substation. When, however, the same total kvar of capacitors is divided into smaller banks and placed on primary feeder circuits, you may run into overvoltages on light load and resulting need for automatic switching.

On some industrial systems, however, putting capacitors in small banks on primary feeders does not cost more than one large bank. Capacitors on primary feeders are then preferable to one large bank in plant substation. But when additional cost is met in installing small banks on feeders, their use must be justified by released capacity in primary feeders, larger increase in voltage, and possibly some reduction in losses.

Then again, capacitor banks may be located on 480-v side of secondary unit substations. But cost of 480-v capacitors is slightly higher than 2400-v units. So whether capacitors are installed on high or low side of secondary substations depends on whether the secondary transformer capacity released is valuable enough to warrant additional expense.

Connecting at Load. Many smaller capacitor units may be located right next to low-pf loads. This type of installation provides most benefit since all transformers and circuits are relieved of wattless current.

Capacitor-switching equipment can be eliminated by placing capacitors on load side of switches that control low-pf loads. When load is switched off, capacitor bank is automatically disconnected. Because no additional switching equipment is necessary, this arrangement offers all the advantages of placing capacitors close to system loads. Since, however, many capacitor units are connected to loads not energized during system peaks, investment in capacitor units is usually higher.

If capacitors are tapped across terminals of an induction motor, it is important that capacitor size be held within certain limits. When such a motor is disconnected from the line, capacitor acts as an excitation source for motor. Motor then becomes an induction generator. If conditions are right motor will generate high voltages that can damage insulation of both motor and capacitor. Possibility of getting these overvoltages can be eliminated by limiting capacitor size to that needed to supply motor's no-load excitation kvar.

Capacitor Size. Total amount of shunt capacitors is influenced both by the reason they are being installed and their ultimate location.

If only reason is to increase plant pf, capacitors are usually installed in one bank on the primary supply. With this arrangement, amount of capacitors that can be used depends only on plant load, existing pf, and how much pf correction can be economically justified. Decision on amount of correction to make is made by weighing saving in power billing for various pf's against initial cost of capacitor kvar necessary. Under some rates pf clause may be such that it is economical to correct to 95% or higher. Yet with others, a pf correction above 90% may not prove justifiable.

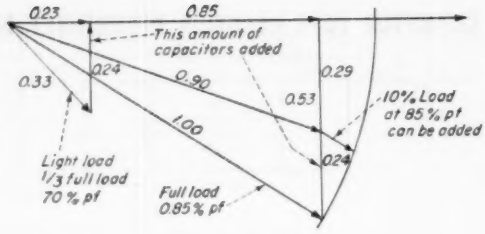
After determining capacitor size that can be economically installed, make sure this amount will not produce excessive voltages at light load. *Keep capacitor size to less than 25% of motor kva.* In most plants, group capacitor installations pay for themselves in from one to three years by savings in the power bill.

Capacity Release. Where capacitors are installed to release some system capacity as well as to improve pf, they are usually spread around the system. Amount of capacitor kvar applied is usually limited to that needed to correct to unity pf at light load. Unless capacitors are switched with load, using more than this will produce overvoltages during light-load periods. Fig. 4 shows amount of system capacity released by adding just enough capacitors to get unity pf at light load. Assumption is that full-load pf is 85% and light load is one-third of full load at 70% pf. Vector diagram shows that for these conditions capacitors equal 24% of total kva, give unity pf at light load. This amount decreases full-load kva to 90% of its original value. Under average conditions, about 10% of system capacity can be released by correcting light-load power factor to unity.

Switching. Load in many plants varies over a wide range. Hence capacitor kvar needed for desirable pf can

CAPACITORS: APPROXIMATE RELATIVE COST PER KVAR

Voltage	Approx relative cost based on bare units	Approximate cost, $/kvar without switching equipment: Bare units	Small racks up to 360 kvar	Large racks 600 kvar and up
230	2.34	13.20	15.00	15.36
460	1.00	5.65	6.58	7.02
575	1.00	5.65	6.58	7.02
2,400	0.83	4.70	5.84	6.20
4,160	0.83	4.70	5.84	6.20
7,200	0.95	5.40	7.00	6.81
13,800	1.27	7.20	——	7.31



4 Rule of thumb for calculating capacitor size: Correct to unity pf at light load. This releases about 10% capacity

produce overvoltages during light-load periods. Overvoltages in turn cause overexcitation of motors and transformers, and can result in an objectionable amount of harmonic current in the system. In such cases consider switching some capacitors with load.

Capacitors can be switched manually or automatically. Automatic switching can be controlled by time switches or in relation to voltage, current, or kvar. Since commonest reason for switching is to prevent overvoltage, capacitors are usually switched on and off in response to plant voltage. Equipment necessary to do this includes: a voltage relay, a time-delay relay to prevent unnecessary switching operations, and an electrically-operated switch or breaker. In addition, if capacitors are switched in more than one step, relays to provide step-by-step operation in either direction are needed. A shunt-capacitor bank, without provision for switching, increases plant voltage but does not affect voltage variation with changes in load.

Capacitor Protection. Probability of failure in any individual capacitor is small. But they are usually applied in banks. So, possibility of failure of one unit becomes a significant factor. Hence it is general practice to install fuses that automatically disconnect a faulted capacitor.

The breaker that controls the circuit on which capacitors are installed does not provide adequate protection against capacitor failures. Reason: In general, breaker does not trip on the low fault currents that can result from internal failure in a capacitor.

Dielectric in modern capacitors is nonexplosive and noninflammable. But a capacitor fault produces large volumes of gas. And under proper conditions, amount of gas generated is enough to rupture capacitor case. Failure of a case usually results in mechanical damage to adjacent capacitor units. And it can produce a line-to-ground or a line-to-line fault on the system. For these reasons, it is desirable that fuses installed with capacitors have a time-current characteristic providing protection against case rupture.

Shunt capacitors can be protected by either group fuses for an entire bank or individual fuses on each unit. Fig. 2 shows general setup for both group and individual fusing.

Characteristic curves for fuses used in a group installation are shown in Fig. 3. Time-current curves for probable and improbable failure of a capacitor case are included. These show that no fuse rated over 50 amp can be depended on to interrupt fault current before capacitor case fails. Also, our tests show that heavy fault current flowing for only one-half a cycle can cause case rupture. A group fuse usually cannot be relied on to interrupt within a half cycle. Thus group fusing is often inadequate.

Individual Fuses. When a fault occurs in one capacitor unit, Fig. 2, others discharge into faulted unit. Individual fuse on faulted capacitor receives high discharge current and clears the fault in a fraction of a cycle. This phenomenally short clearing time comes about because natural period of oscillation within capacitor group is of the order of thousands of cycles per second. Heavy, high-frequency discharge currents from capacitors melt the individual fuse and force a zero current. This is enough to complete interruption before line current can increase to a dangerous value. This characteristic of an individual-fuse installation provides adequate protection against case failures.

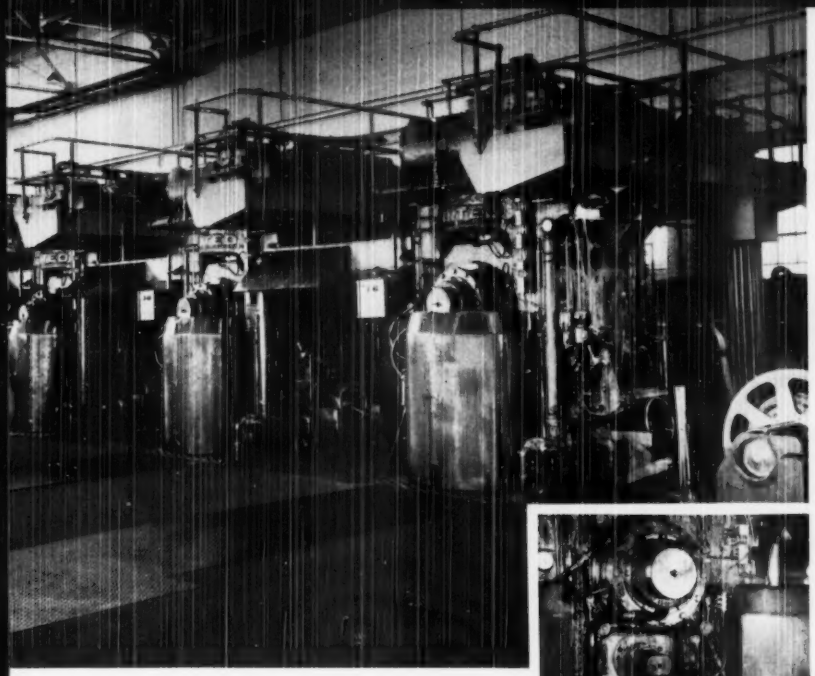
To summarize: Group fusing is cheaper and takes less space than individual fusing. On the other hand, individual fuses give better protection, substantially eliminating possibility of capacitor-case failure. And a fault in one unit will not disconnect an entire bank. These two advantages are usually important enough to justify individual fuses.

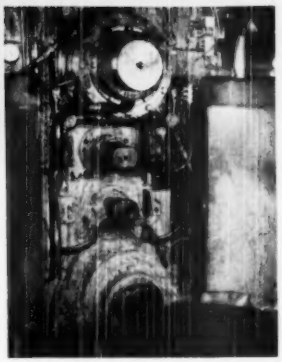
Series Capacitors. Series capacitors can also be used to advantage in some plants. Commonest application is in conjunction with electric welding and electric furnaces. These fluctuating loads frequently cause objectionable voltage variations. Ordinary voltage-regulating equipment does not respond fast enough to prevent recurring voltage dips. Series capacitors, however, act as voltage regulators with instantaneous response, making them valuable for correcting flicker.

Capacitor rating for a series installation is usually fixed by the normal load current of the circuit involved. Series capacitors are designed to withstand momentary currents up to 150% of their rating. It is not economical, however, to use a capacitor with a rating high enough to withstand voltage across it during a fault. Instead, it is best to provide some means for limiting voltage across a series capacitor to about twice capacitor rating. In most cases, this is handled by a specially designed gap in parallel with the capacitors.

There are a number of special problems that may arise in using a series capacitor. These include resonance, self-excitation of motors and hunting of synchronous machines. In the past they were solved by placing resistance in parallel with the series capacitor. To determine if a series capacitor involves any of these problems requires a detailed engineering analysis of the system. Many successful installations of series capacitors have been made in recent years, the most outstanding being a 10,000-kva unit installed on a 66-kv line of Duquesne Light Company.

Looking back on installations of yesteryear, we find the using of shunt capacitors to good advantage on industrial distribution systems was first considered about 25 years ago. Today the shunt capacitor is a well-established component of most industrial power systems. Naturally there are a number of questions to answer in planning a capacitor installation in a plant. But the two most fundamental ones are: How much capacitor kvar should be installed? Where should it be located?





Putting the "squeeze" on maintenance costs

IN this modern 5-stand tandem cold-rolling mill at a midwest steel mill, giant backup rolls squeeze strip steel to thousandths of an inch thickness. Taking the brunt of this punishing work are the end bearings on the rolls. Protection and proper operation of these bearings call for a lubricant that can really take it.

Recommended by a Standard Oil lubrication specialist, a STANOIL Industrial Oil has been used on these bearings for 1½ years of hard, continuous operation. Clean, effective lubrication, together with excellent maintenance practices by mill operators, has held bearing-upkeep costs to a minimum. The oil-circulating system, which includes two 6,000-gallon oil tanks, has remained entirely clean. STANOIL has shown practically no deterioration in use.

You can rely on this unique multi-purpose oil to give you the same, clean, dependable service in hydraulic units, speed reducers, and circulating systems. You can rely, too, on the expert, on-the-spot service of a Standard Oil lubrication specialist. How you can obtain his help, quickly and easily, is explained at the right.

Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Ill.

STANOIL
TRADE MARK
Industrial Oil

What's YOUR problem?

Warren Erickson, Lubrication Engineer at Standard Oil's Chicago office, helped this midwest steel mill (see left) make important savings through the use of STANOIL Industrial Oil on a cold-rolling operation. He was close at hand, gave mill operators engineering service when they needed it.

There's a corps of Standard Oil Engineers and lubrication specialists throughout the Midwest. You'll find one located near your plant. You can reach him simply by phoning your local Standard Oil Company (Indiana) office. His experience and special training will help you get maximum benefits from STANOIL and other outstanding products such as:

STANICUT Cutting Oils. These special-duty cutting oils meet today's most exacting requirements and highest production schedules. Grades vary in viscosity and compounding. Each contains the correct proportion of extreme-pressure and friction-reducing ingredients.

STANICOOL HD Soluble Oils. Because of additional compounding, these heavy-duty soluble oils possess the cooling ablity of an emulsion and also give better tool life and finer finishes than do conventional soluble oils.

STANOSTAMP Compounds. These widely accepted products have demonstrated their ability to handle heavy stamping or drawing operations of low-carbon or alloy steels. Each of the three grades is a paste compound to which water can be added to provide the most economical applications. STANOSTAMPS offer maximum protection for dies and work, can be readily removed in conventional washing equipment.

STANDARD OIL COMPANY (INDIANA) STANDARD

What's YOUR problem?

● Troubled with fingerprint corrosion? Are parts rusting between machining and assembly? Do you get customer complaints because of rusted shipments? These and a score of other troublesome problems can be eliminated with the use of the right STANORUST Rust Preventive.

To help you get the maximum benefit from the STANORUSTs, Standard Oil has a corps of lubricating specialists located throughout the Midwest. One of these men is near your plant. You can get his services quickly and easily. His wide experience and special training in rust prevention will help you make real savings. Why not arrange today for his visit by calling the nearest Standard Oil (Indiana) office?

8 grades of STANORUST

STANORUST No. 3-FP
is a fingerprint remover. It can be used to eliminate the cause of fingerprint corrosion and to deposit a protective film in one simple dipping operation.

STANORUST No. 4-V
has a Stoddard-solvent base which evaporates to leave a thin film for temporary rust prevention.

STANORUST No. 12
provides economical protection under average indoor conditions. It can be applied cold.

STANORUST No. 95
is designed for protection of parts in moderately severe indoor storage. It also can be applied cold.

STANORUST S-1
is a semi-fluid product, designed to give protection over a longer period than the No. 95 grade. It is suitable for outdoor service, if parts are under cover.

STANORUST 1-XC
is a non-fluid product which is recommended for protection of parts under severe outdoor conditions. It has been thinned with a volatile solvent and can be applied cold with a swab or brush.

STANORUST 3-X
is a soft, grease-like product and offers protection against severe indoor storage and moderately severe outdoor conditions.

STANORUST 6-X
is a heavy, petrolatum-type product that protects against the most severe outdoor exposure. It meets a government specification which includes a requirement that it protect against corrosion for a period of not less than 10 years without renewal.

For maximum protection against rust . . .

● STANORUST Rust Preventives offer maximum protection against rust because they contain a moisture-displacement additive which makes them far superior to straight mineral oils or to petrolatums frequently used for rust prevention.

The STANORUSTs have been thoroughly tested and proved effective on a wide variety of rust prevention jobs, ranging from elimination of fingerprint corrosion to protection of equipment under severe outdoor storage conditions.

The complete STANORUST line is briefly described at the right. The booklet offered will bring you complete details. You can secure a copy by calling the local Standard Oil (Indiana) office or by writing 910 South Michigan Avenue, Chicago 80, Illinois.

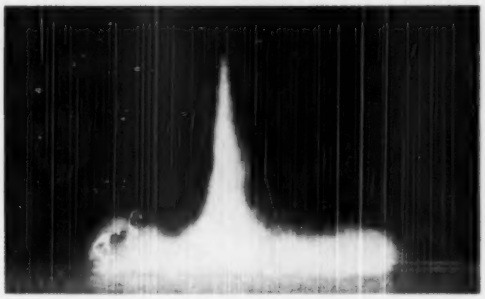
STANORUST
REG. U. S. PAT. OFF.
RUST PREVENTIVES

SEND FOR THIS BOOKLET

STANDARD **STANDARD OIL COMPANY (INDIANA)**

Going from normal projection pattern to long downward throw...

1 Smoke photo shows pattern normally produced by projection heater. Room air blends with the warmed air from the unit



2 With adjustable diffuser, unit directs heat straight down from waste pocket to comfort zone. Throw is 60% greater

...or from down-and-out pattern to softly descending blanket...

3 Change in diffuser setting gives down-and-out pattern good for blanketing an open doorway and diffusing air about room

4 With diffuser blades completely closed, heated air spreads in horizontal plane. This works well under a low ceiling

...Unit Heaters Show Their Versatility

► UNIT HEATERS fitted with adjustable diffusing vanes can make heated air do tricks. So engineers of Trane Co. at their La Crosse, Wis., laboratory, wanted to show dramatically the wide variety of air-throw patterns possible. With the help of smoke bombs and skillful photography by Hedrich-Blessing Studios, Chicago, they succeeded.

Starting with a projection-type heater, without diffuser, the technicians released a bomb in a smoke accumulator above the unit. As they measured air circulation, the photographer's flashlight and camera recorded the patterns formed. Then a diffuser was fitted to the heater and the new patterns made possible by its adjustment were similarly recorded. A further series of test patterns was produced with a horizontal unit heater carrying an adjustable diffuser.

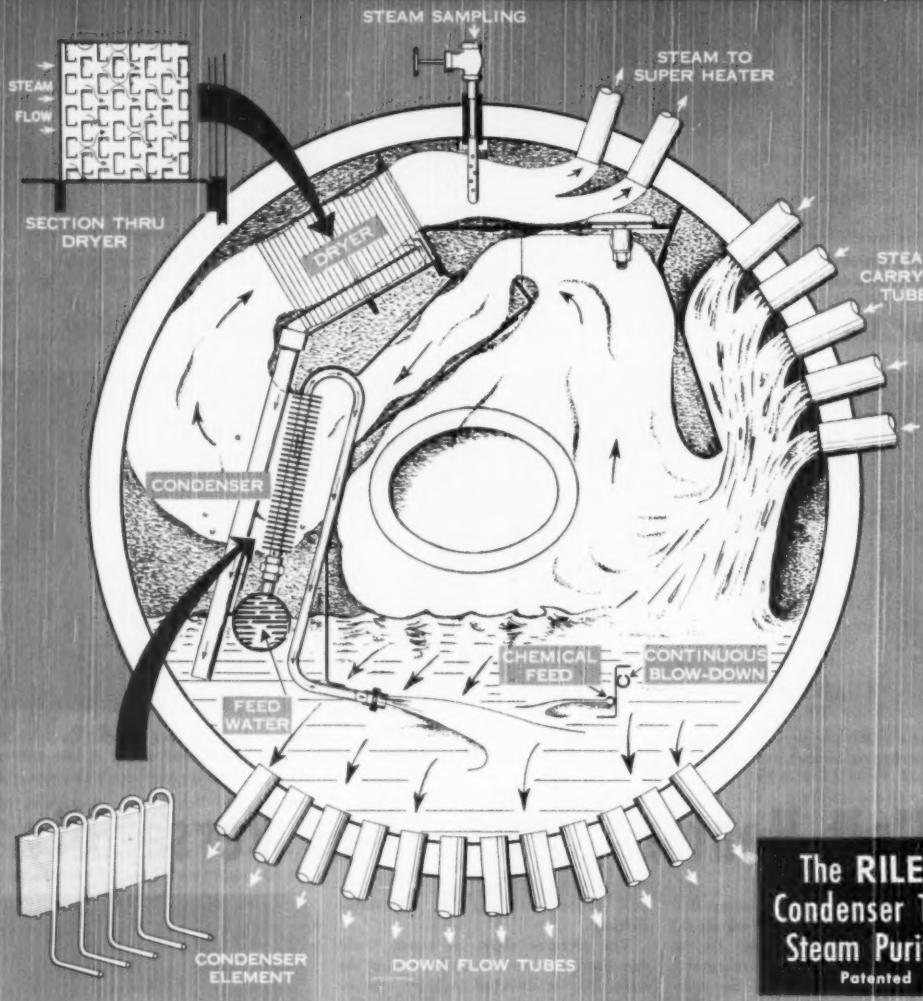
The pictures show, as words could not, the many ways heated air from the units can be directed to solve specific problems in industrial buildings. Not only does such heater versatility give a variety of answers to application needs. But also, by suitable adjustment, heater action can often be changed to meet new conditions, without relocating the unit and its piping.

Diffusers used in these tests are adjustable without tools. The device for projection heaters consists of 24 adjustable blades fitted between a die-cast hub and a cone-shaped spun-steel rim. Diffuser for horizontal heaters has, in most cases, seven horizontal and 56 vertical blades.

5 Lab worker shows how setting of the diffuser blades is easily adjusted

For more photos on unit heaters, turn to page 108

Exceptional steam purity with the



The RILEY Condenser Type Steam Purifier
Patented

TRADE MARK Rx REGISTERED

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston · New York · Philadelphia · Washington · Buffalo · Pittsburgh · Cleveland · Detroit · Chicago
Cincinnati · Atlanta · New Orleans · Memphis · St. Louis · Kansas City · St. Paul · Tulsa · Houston
Denver · Salt Lake City · Los Angeles · Portland · Seattle

BOILERS · PULVERIZERS · BURNERS · STOKERS · SUPERHEATERS · FLUE GAS SCRUBBERS

New Riley Condenser Type Purifier

Silica carryover reduced to minimum

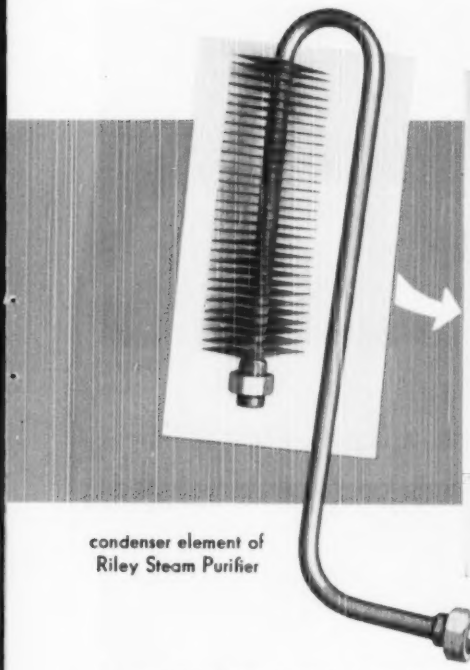
Exceptional steam purity with a minimum of silica carryover is being obtained from Riley Steam Generating Units equipped with the new Riley Condenser Type Steam Purifier. Steam purity well below 0.5 ppm is consistently obtained at installation after installation even with high percentage of make-up.

With Riley units, steam is liberated above the working water level promoting ready separation of steam and water. The condenser type purifier not only removes most of the total entrained solids from the steam but also sufficient quantities of the volatilized silica to greatly minimize difficulties from silica scale on the blades of intermediate turbine stages—an important feature with high pressure installations.

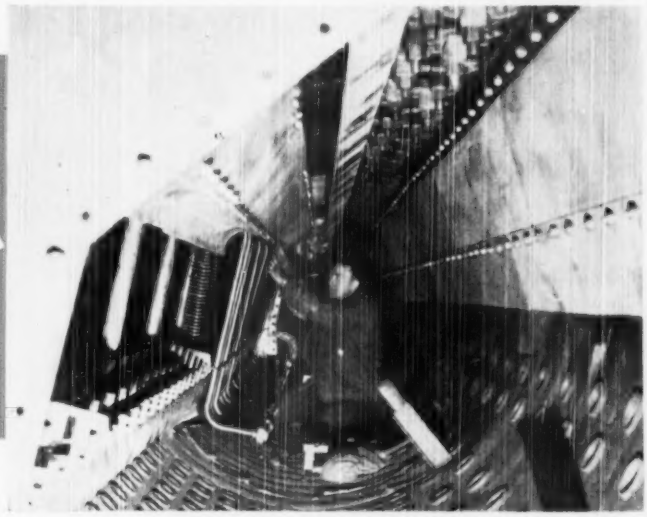
The Riley condenser type steam purifier is ruggedly constructed and securely mounted in the drum to maintain proper alignment. It occupies a minimum of internal drum space, providing ample space for inspection and cleaning of tubes connected to the drum with a minimum of dismantling. Weight of the individual purifier elements permits easy installation and removal.

Riley engineers will gladly give you detailed information about this important Riley development. Phone or drop a line to the nearest Riley office.

You Can Rely on Riley?



condenser element of
Riley Steam Purifier



View of Internals of Riley Steam Drum
Note ample space for inspection

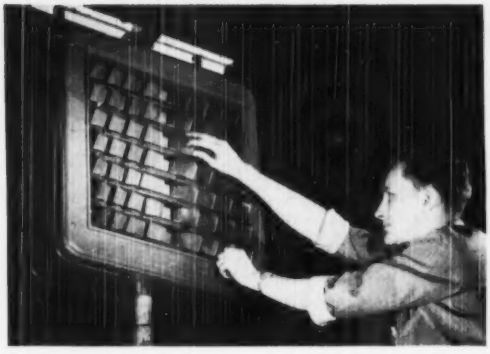
A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

COMPLETE STEAM GENERATING UNITS

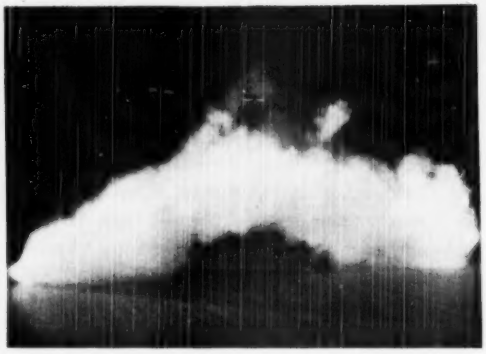
. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS · WATER-COOLED FURNACES · STEEL-CLAD INSULATED SETTINGS · AIR HEATERS

Simple change in diffuser setting gives a 2-way stretch...

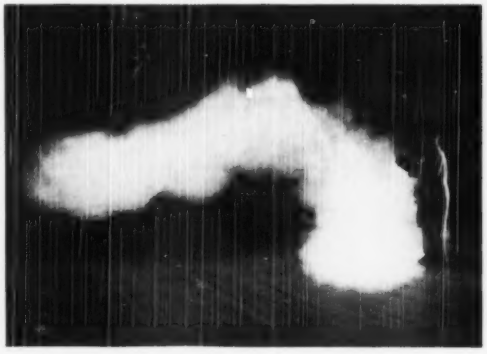


6 Diffuser for a horizontal heater has 56 blades and seven horizontal louvers. Here worker sets half right, half left



7 This split pattern, with warm-air stream divided into two distinct channels, results from adjustment shown at left

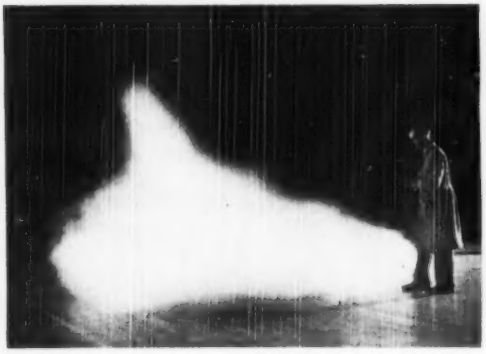
...a half-and-half pattern, a shift to the right side...



8 With half of louver fins straightened and half turned to left, heater can blanket a doorway and cover a work area

9 Another change in louver setting, turning all fins 30 deg, directs heat to right, avoids change in heater's location

...a long forward throw, or a blastless diffused closeup



10 Now blades are toed in and heater projects narrow stream straight ahead. Throw distance is 25% greater than normal

11 For widespread flow of low-velocity air, close to workers, alternate rows of the fins are set in opposite directions

Ladish Elbows

...A Complete Size Range Another Reason to Specify *Controlled Quality*

SEAMLESS WELDING FITTINGS

From the small fitting that weighs several ounces to the half-ton giant . . . whatever your fittings requirement, the Ladish line provides you with an unrestricted choice of sizes in a complete range of types, weights and materials. In addition, every fitting offers the added dependability assured by the high manufacturing and metallurgical standards of Ladish Controlled Quality.

THE COMPLETE FITTINGS LINE
PRODUCED UNDER ONE ROOF...ONE RESPONSIBILITY

LADISH CO.

CUDAHY, WISCONSIN
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DISTRICT OFFICES: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland • Chicago
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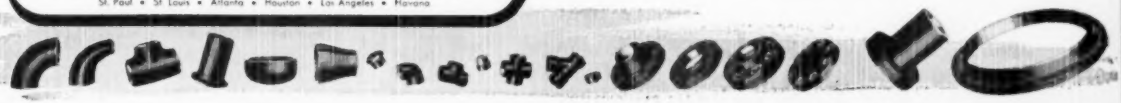
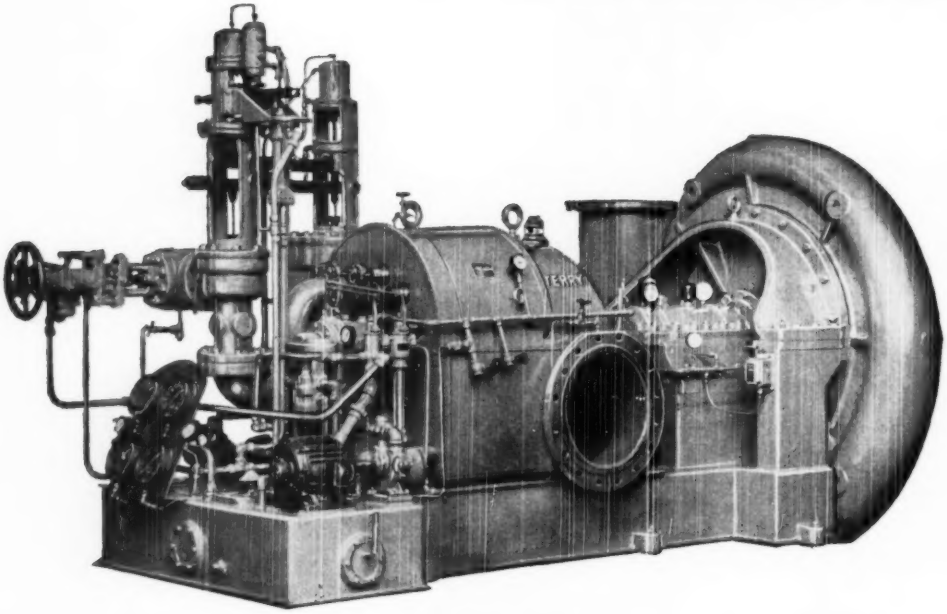


The TERRY TURBINE



SPECIAL PURPOSE TURBINE

FOR OPERATION UNDER ALL THESE CONDITIONS:

1. Straight, high-pressure, condensing
2. Straight, low-pressure, condensing — putting to work excess low-pressure steam.
3. Mixed pressure — using the low-pressure steam available, with only enough high-pressure steam required to drive the compressor
4. Condensing bleeder operation — providing clean, low-pressure steam for heating or process work

. . . and the speed under any of these conditions can be varied from 2800 to 4750 rpm.

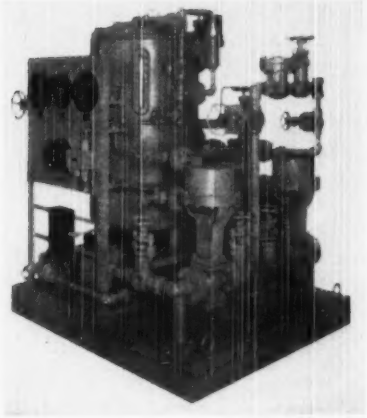
This is but one example of many unusual combinations developed by Terry to meet out-of-the-ordinary requirements in turbines up to 2000 hp. Information on a special-purpose turbine for your specific requirements will be gladly furnished.

T1177

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.

LETTERS FROM A TURBINE SPECIALIST—14

By C A LILLY, JR and I J DILTS, *Turbine Divisions, General Electric Co*



SEAL-OIL SUPPLY UNIT automatically conditions the oil used to prevent hydrogen leaking out of generator along main shaft

HYDROGEN COOLING OFFERS MANY GAINS

Dear Mr Specialist,

During our talk about the size of our next turbine-generator set the other day, you proposed to offer a hydrogen-cooled generator for the 15,000-kw unit. As you know, all our present generators are air cooled. I would like to know more about the reasons for going to hydrogen. There is, of course, a decrease in windage loss with hydrogen, but it seems that helium would give almost the same gain.

I would appreciate your dropping me a note explaining why hydrogen is used in generators.

Yours very truly,
ENGINEER

Dear Mr Engineer,

Hydrogen cooling has been an important factor in the great strides made in building large turbine-generators. I am glad to tell you about hydrogen's advantages.

You mentioned increased efficiency from reduced windage loss with hydrogen. This loss varies directly with gas density. Using hydrogen instead of air cuts this loss by 90%. The corresponding increase in full-load efficiency is 0.8% for a 15,000-kw generator. A saving of about $1900 per year will be realized, assuming a cost of 0.2 cents per kwhr. The saving accrues even when generator runs at light loads, since decreased windage represents a reduction in fixed losses.

A saving in building space will be realized since a hydrogen-cooled generator is 20% smaller than a corresponding air-cooled unit with similar electrical characteristics. From another viewpoint, for generators of the same physical size operating temperatures will be much lower with hydrogen cooling. Hydrogen has excellent cooling properties compared with air.

Maintenance expense will be reduced because oxygen, moisture and dirt are excluded from windings. With a sealed hydrogen system, in an atmosphere free of oxygen and moisture, insulation retains its quality and flexibility longer than when in air.

An atmosphere of hydrogen will not support combustion. This localizes any damage from an internal fault.

Increased versatility in hydrogen-cooled generators arises from operation at higher pressures than the 0.5 psig at which generators are normally rated. Because of improved cooling qualities of hydrogen at increased pressures, generator kva may be increased 1% for each psi increase in pressure up to 15 psig, without exceeding normal winding temperatures. Also, in case of abnormally high cooling-water temperatures, generator output can be maintained at rated value without exceeding normal winding temperatures simply by increasing hydrogen pressure about 1 psi for each deg F increase in water temperature.

Operating hydrogen-cooled generators is easy. Normally, only work involved is replacement of hydrogen cylinders as they become exhausted. About one 200-cu-ft cylinder of hydrogen per week will be used by a 15,000-kw generator running at 0.5 psig.

Auxiliary equipment of a hydrogen-cooled generator consists of three parts: (1) hydrogen control unit (2) seal-oil supply unit (3) purging unit. Hydrogen control unit automatically maintains purity of hydrogen in generator casing at 97% or higher. Because hydrogen-air mixtures will not burn or explode at purities higher than 75%, the 97%-purity level insures safe operation.

Seal-oil supply unit automatically maintains a flow of oil to shaft seals which prevent hydrogen leakage along the generator shaft.

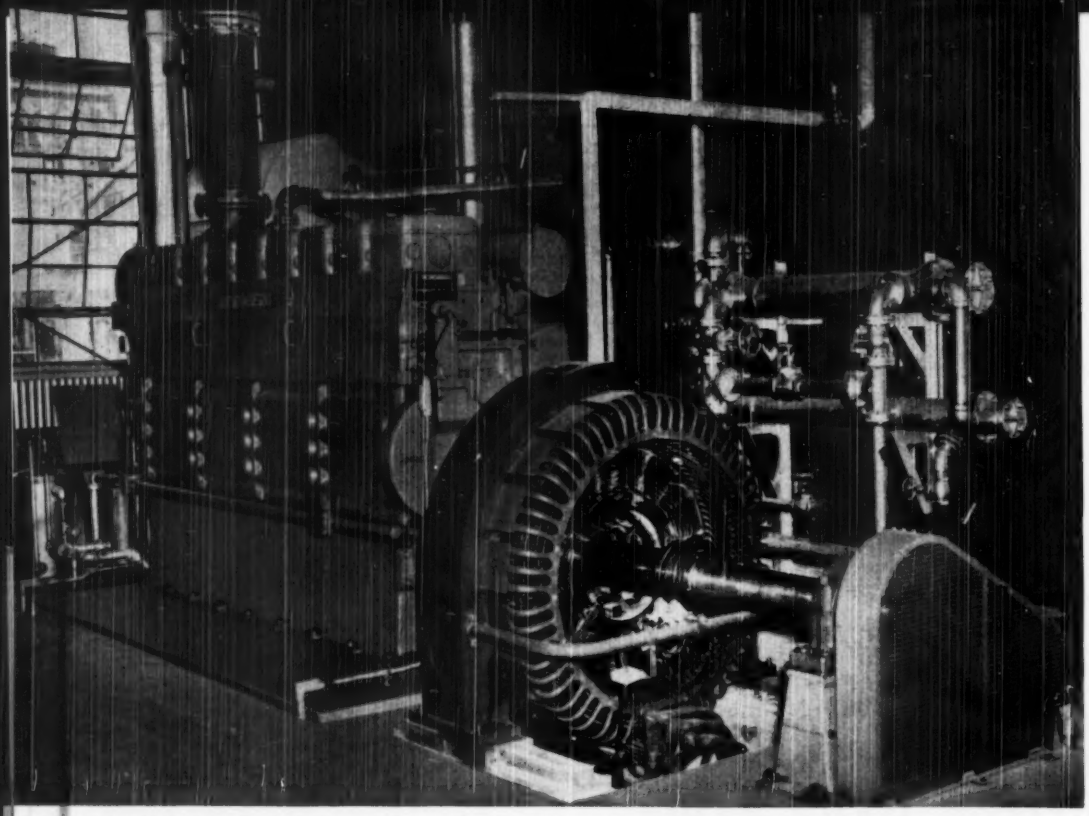
Purging equipment provides a means of introducing an inert gas, usually CO_2, into the generator casing during filling and emptying operations. CO_2 first displaces air in the casing, then the hydrogen displaces the CO_2. This avoids explosive hydrogen-air mixtures during filling operations. The reverse procedure removes hydrogen from the casing. Casing is usually filled at standstill, but it may be done while generator carries load. When operating in air, capacity runs about 60% of nameplate.

Helium has been proposed and studied because it is non-combustible and has a low density, about twice that of hydrogen, but still much lower than air. A helium-cooled generator would be about 10% larger than a hydrogen-cooled unit of similar electrical characteristics, because cooling properties of helium are inferior. Except for its larger size, a helium-cooled generator would be much like a hydrogen-cooled unit. A gas-tight casing, shaft seal, and auxiliary equipment to maintain purity at high value would be needed to obtain benefits of low density. Helium, however, is much more expensive and not as readily available.

Thus, helium will not simplify the generator or auxiliary equipment. It will not do as good a job of cooling and it costs more; hence it is not competitive with hydrogen.

Hydrogen cooling results in higher efficiency, reduces size of generator for given rating, lowers maintenance cost, increases safety, increases versatility, all of which are real benefits. We can discuss this at our next meeting.

Sincerely yours,
TURBINE SPECIALIST



STANDBY DIESEL is 718-hp unit, 9x11½-in., driving a 500-kw alternator. The cooling-water system is designed to permit heating jacket water during periods engine is idle. Every 4 hours lube oil is pumped by hand through engine when idle

Standby Diesel Pays in 5 Minutes

Spoilage of glass products, damage to process machines and shutdown of all services would speedily result from failure of purchased power in this plant. To avoid expensive outages, a standby diesel generating unit was installed. Special cooling system, good care of engine lubrication, proper training of the personnel give dependable standby power for process

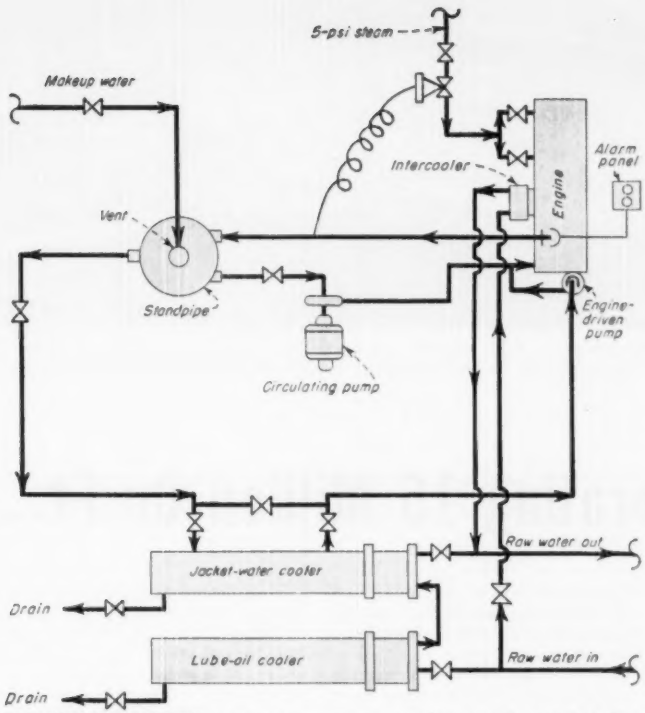
► WE PAID FOR our 718-hp standby diesel in five minutes. That may sound like a tall story, but that's exactly what we did by careful selection and planning. To understand how we could pay for an engine so fast, let's first look over the power needs that led to choice of this standby unit.

Our plant, the Santa Clara, Calif. branch of Owens-Corning Fiberglas Corp, manufactures and fabricates products from glass fibers. Batch is converted to glass in a furnace and stored there in molten state, ready for use. Furnace or glass-tank refractory needs both fan and water cooling 24 hours a day, 365 days a year. Thus, current is needed every hour.

Power for lighting, water-supply pump drive, fire-protection system, and complete steam-plant operation is also needed in emergencies. We could not operate without standby power. Power interruption for more than five minutes causes expensive outages and damage to process machinery, especially the glass furnace. Normally power is purchased from Pacific Gas & Electric Co.

Standby Unit. Since utility lines had failed in the past, we selected an independent standby unit—a 718-hp supercharged 4-cycle mechanical-injection Nordberg diesel. This 8-cylinder 9x11½-in. engine operates on light diesel oil and drives a direct-connected GE 500-kw 480-v 3-phase 60-cycle alternator at 720 rpm. Exciter is 7.5-kw 125-v 1750-rpm belt-driven unit. A control center with switchgear and instruments for taking over load from utility lines is used for generator control. Standby unit is housed within steam plant on a continuous, one-piece concrete foundation.

Fuel, lubricating-oil and air-starting systems follow standard diesel practice. When planning the cooling-water



COOLING-WATER SYSTEM is fed with low-pressure steam during idle periods to keep water at 120 F. Small circulating pump maintains constant flow through jackets

By CLYDE CROFT,

Systems Supervisor
Owens-Corning Fiberglas Corp
Santa Clara, Calif.

system we made several changes to better suit unit for standby service.

As piping diagram shows, cooling system is self-contained unit. An integral engine-driven pump circulates water from engine jackets to a standpipe and heat exchanger. Jacket water is maintained at 120 F by low-pressure steam when engine is idle. This steam is fed to jackets through a temperature-actuated valve. A small electrically-driven circulating pump maintains flow through the system when engine is idle. Keeping engine warm permits immediate loading on startup, prevents condensation during down time.

Standby Care. This installation was planned for quick starting and loading. Thus, there is little chance of losing expensive production time on process equipment or damaging it.

Besides heating engine jacket with low-pressure steam, we circulate lube oil every four hours. Hand pump in lube system circulates the oil. With oil pumped to engine six times a day, unit is always ready to roll. Several emergencies have shown the procedure is entirely satisfactory.

Since steam-plant personnel run this standby diesel, we load the unit every Wednesday for 15 minutes. Each shift starts the diesel and synchronizes it with PG&E lines. This operation serves two purposes: Steam-plant personnel is kept familiar with operation and we are able to make spot checks of engine condition. In all emergency starts we've made, unit has been on the line and carrying emergency load within three minutes after outside power failure.

To be doubly sure of starting standby diesel we installed both an electric motor and a gasoline engine for starting-air compressor drive. Starting-air pressure is 250 psi.

Control Panel. We fitted a GE metal-enclosed dead-front switchboard with one 1000-amp 3-pole dual-magnetic trip, electrically operated air-circuit breaker and the generator voltmeters and ammeters. On the board are also an integrating watthour meter with demand register, wattmeter, synchroscope, and frequency meter. Two circuit-breaker operating switches fitted with pilot lights for generator and transformer breakers permit easy control.

Exciter field current and voltage meters are mounted on the board for easy reading. Governor motor control switch, voltage regulator, synchronism-check relay, anti-motoring relay, current and potential transformers are other devices we figured necessary for dependable standby operation.

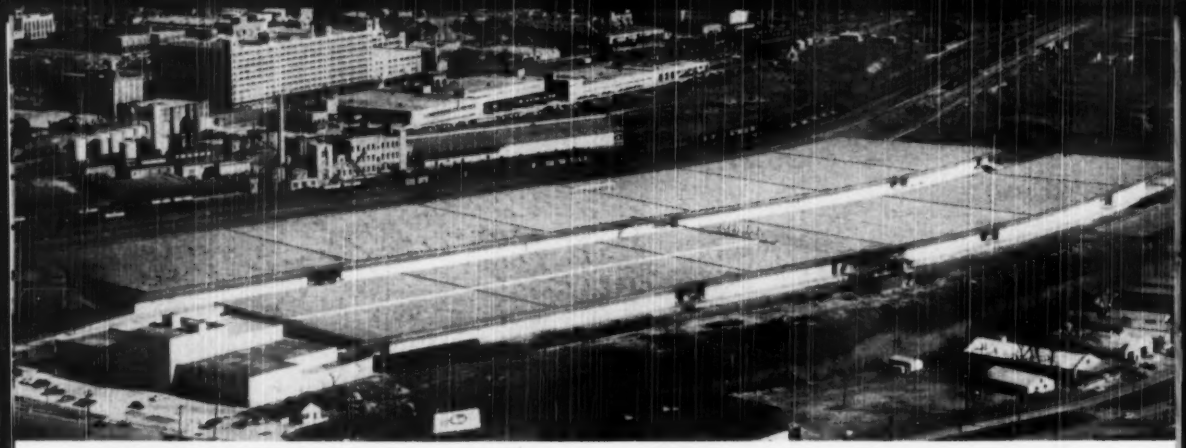
Operating Procedure. Standby procedure is based on picking up load in shortest possible time with minimum chance of faulty starts. Briefly, we put load on standby unit as follows:

As soon as outside power fails operator starts diesel manually. When it's up to speed he adjusts voltage and frequency. Governor switch adjusts frequency; rheostat adjusts voltage. Diesel is ready to supply power to unit substation.

Plant subfeeders run from substation to process and other units. When outside power fails, undervoltage-relay trips substation secondary breaker. With diesel ready to go, operator checks secondary breaker and substation load. If load is less than unit capacity, he closes generator breaker. This puts substation on standby generator.

To parallel standby generator with normal power supply, operator starts manually, adjusts frequency and voltage. With unit synchronized, he closes generator breaker through synchronism-check relay. Load is transferred to standby unit by manipulation of governor control switch. If, during this time, normal power supply drops or fails, transformer breaker is tripped by its reverse-power relay. Standby unit then carries all unit-substation load. Reverse procedure takes standby unit off line.

Operating Experience. Since installing this standby unit we've had eight power failures without warning. We had standby unit on line and supplying emergency power within three minutes each time. Once outside power was off $2\frac{1}{2}$ hours, but standby unit carried plant load without trouble. Since power failures are so costly to process units we saved, in five minutes, the diesel's cost. Careful planning has given us a unit well suited to our needs. Its daily care with the weekly start, prove well worth the effort.



GIANT DALLAS PLANT of Alford Refrigerated Warehouses consists of two parallel one-story buildings 1650 ft by 250 ft. One, for dry storage, holds air at 65 to 70 F. The other, for cold storage, has 7,000,000 cu ft of freezer and cooler space

Refrigerating 15 Million Cu Ft...

► AS VOLUME OF MERCHANDISE handled by cold-storage warehouses kept growing, old methods of operation needed streamlining. In the forefront of this move was Fred A Alford, president of Alford Refrigerated Warehouses, Dallas, Texas. He championed the idea of one-story units designed for speedy, easy, mechanized handling of merchandise and high operating efficiency. Latest example is the vast Alford warehouse recently completed in Dallas.

This consists of two parallel high-ceiling one-story buildings, 1650 ft long and 250 ft wide (photo above). On each side of each building runs a full-length 15-ft loading dock. One building is for dry storage, the other for cold storage. The engineering that went into making these buildings work as intended was considerable. Right now, let's look at the over-all job. Then we'll come back to how's and why's of equipment selection.

Physical Layout. A 100-ft private street separates the two long warehouse buildings and allows truck traffic to and from loading docks facing it. Outboard sides of buildings have double-track rail sidings serving loading docks, Fig. 1. For ease of operation, building floors and docks are at same level—truck and car loading height. Each building roof overhangs the docks 20 ft on each side. This affords protection during loading operations and by shading sides of buildings cuts solar heat load.

Fronting the cold storage building is a 4-story completely air-conditioned office building. In addition to general warehouse offices it houses food-brokers' offices and other business of a kindred nature plus a 400-seat auditorium for general use.

The two warehouses are identical in general construction. Both are insulated with approximately 12 in. of shredded redwood bark. The roof construction, Fig. 3, consists of bar joists with a concrete deck on top covered with embossed aluminum sheeting for heat reflection. Corrugated aluminum is placed between bar joists, resting on bottom flanges. Space between is filled with insulation. This construction makes it possible to convert dry-storage building to cold-storage use if needed.

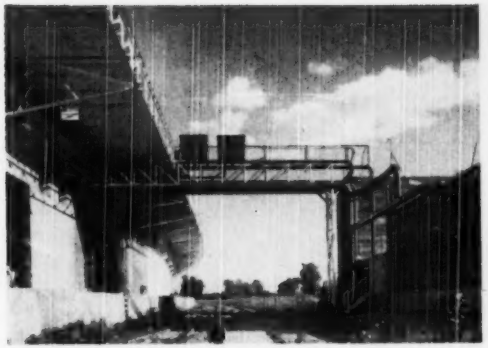
Dry Storage. Since both buildings are constructed alike, let's pause and examine the differences as far as engineering planning goes. The 8,000,000-cu-ft dry storage with its six main rooms requires holding temperature, year round, between 65 to 70 F. This is done by circulating hot or cold water through 120 finned-surface blower units located just under the ceiling, Fig. 2. Cold and hot water comes from a central engine room (described below) in the cold-storage building across the street. Hot water for winter heating load of dry storage and office building is obtained from gas-engine jackets at 150 F. Heat recovery from this source, ordinarily dissipated in a cooling tower runs about 4000 Btu per bhphr.

Cold Storage. The cold-storage building forms biggest refrigeration load. Equipment or engine room is near center of this building, at roughly mid-point of load. It takes up a space 50-ft wide by 220-ft long, with an average ceiling height of 25 ft. Ventilating fans at either end provide up to 60,000 cfm of air. Engine-room machinery lines both sides of a central clear aisle that runs full length of room. All engine-driven equipment is grouped at one end on a 2-ft-thick reinforced slab, 90 by 40 ft, isolated from rest of floor by expansion joints.

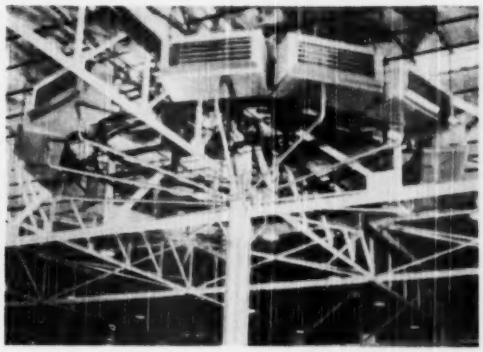
Equipment Services. Services provided by engine-room machinery are: (1) refrigeration by direct-expansion ammonia for freezers in the cold-storage building (2) refrigeration for coolers in this same building by direct expansion in some and cold brine in others (3) ice-making for car-icing (about 60 tons per day) (4) chilled water for air conditioning in office building and air cooling in dry-storage building (5) electricity for all engine room auxiliaries, cooler and freezer fans, building light and power (6) hot water for heating dry storage and office building (7) battery charging for fork-lift trucks.

From the outset, we selected equipment to give flexible operation. We wanted all areas in the cold-storage building capable of service either as coolers or freezers. With this in mind, all headers—ammonia and brine—were sized to handle entire areas for either duty.

To select equipment we had to make certain assumptions but wherever possible we ran a complete analysis of expected operating conditions. We started off by assuming roughly 7,000,000 cu ft



1 Loading docks run building length; rail sidings on outer sides. Pipe bridge connects cooling towers to engine room



2 Forced-air blower units, suspended from ceiling, cool cold-storage rooms. Some use brine, rest are direct-expansion

. . . with freezing, cooling and air-conditioning loads, makes a tough engineering job. E R Hallowell, v-p, Alford Refrigerated Warehouses, tells you how it's done

of cold storage split half for freezer space and half for cooler space. Individual rooms making up these areas vary from 200,000 to 1,000,000 cu ft.

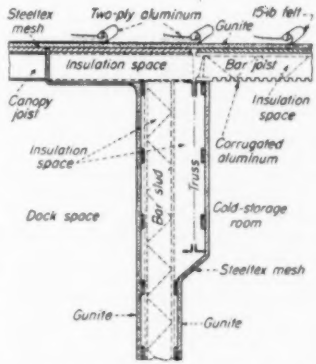
Cooler Units. To cool these rooms we installed forced-air blower units, Fig. 2, suspended from the ceiling. Some cooler rooms, used for edible-nut storage, have cold brine circulating in coils. Balance of coolers and all freezers are fed by direct-expansion ammonia. This way we needed no ductwork and saved on fan horsepower. We mounted blower units in circular patterns, two or more such assemblies to a room, to (1) get positive and even 360-deg air circulation (2) eliminate dead spots (3) give close temperature control. Further, we had smaller temperature differences between air and refrigerant with the blower coils than is ordinarily possible. Thus we could carry higher humidities with less dehydration of storage products.

Central cooling-coil cluster idea proved a helpful maintenance aid. Whenever coils need defrosting, a truck with a built-in pump sends water through central distribution header to three units at one time. This water then drains back to the truck along with coil frost which has been melted by water flowing over the coil. As a further refinement, a piping system is now being laid out with a permanent water supply operatable from outside storage areas. Then coils may be defrosted without use of truck equipment.

Unit-cooler construction for both brine and ammonia units is identical. We picked them on the basis of a 7.5-F split between average room and refrigerant temperatures for freezers, and 5 F for cooler rooms.

Controls for direct-expansion rooms were worked out carefully with all units fully flooded. Circular suction and liquid headers connect from an ammonia accumulator to the ring of units. A float switch maintains liquid level through a solenoid valve with a hand-regulated expansion valve controlling rate of flow.

An automatic suction-pressure regulator controlled by room temperature is used for temperature control. It allows full flooded use of all coils at all times.



3 Same roof construction for dry and cold storage permits replanning use

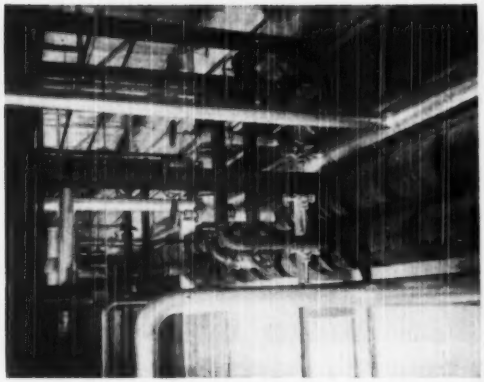
A pilot circuit controlled by an automatic valve similar to a thermal-expansion valve, with its bulb sensitive to room temperature, varies back pressure on each bank of units. This holds room temperature with highest possible suction pressure on coils.

A master switch outside each direct-expansion room can shut down all fans and close all ammonia lines supplying unit rings. If we have an ammonia break we can close off all lines and only ammonia lost would be in the group of units containing the break.

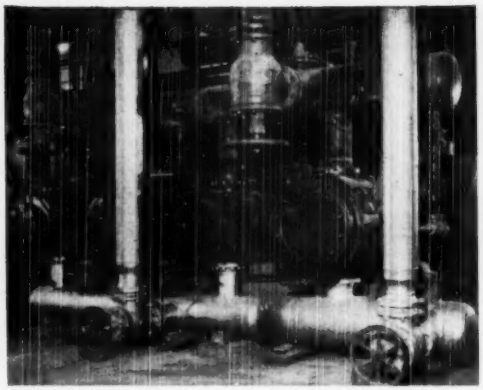
Cooler rooms on brine circulation are temperature-controlled by means of a thermostat and a modulating motorized brine valve. Headers feeding units are circular and similar to those used for ammonia. Brine flow is equalized to the various units. Individual unit valves are not needed.

Total Plant Load. In calculating total duty for the plant, heat-leakage loads for all cold-storage rooms were tabulated. Into this figure went an additional 20% for losses due to door openings, men working, etc. Heat load due to lights was added on a 50% basis and heat from unit fans also.

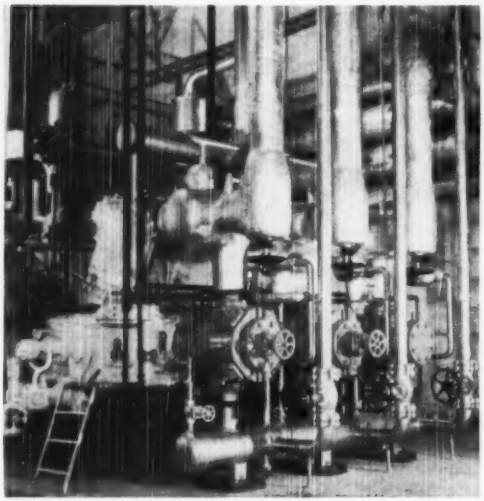
For heat-leakage purposes we estimated outside temperatures of 100 F for wall areas, 120 F for roof and 60 for ground. Freezer loading was put at 1,000,000 lb of product per week with an average latent heat of 100 Btu per lb. Cooler loading was also set at 1,000,000 lb of product per week. Both loads would be distributed throughout various coolers and freezers. Later on, as we



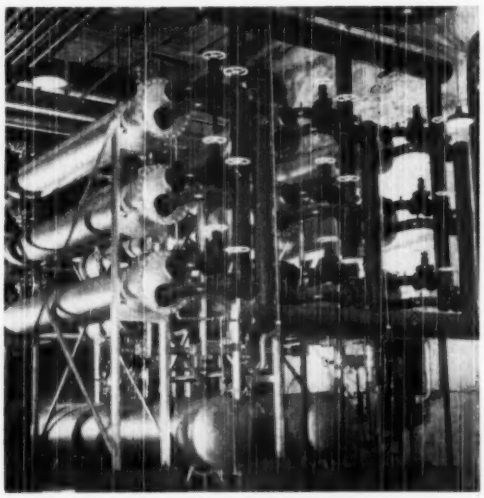
4 Ammonia was picked for refrigerant partly because suction lines are long. Main ammonia headers above, interconnect



5 In main refrigeration units, horizontal double-acting ammonia cylinders are driven by V-type gas-engine cylinders



6 Compressor suction and discharge lines go through surge drums. Headers are cross-connected for flexible operation



7 Horizontal 4-pass ammonia condensers are racked on stands, three high by three wide. Two liquid receivers stand below

started construction, one freezer was actually coiled to be used as a sharp freezer and most of this work for the plant is done in this room.

Refrigeration load thus came to about 236 tons for freezers and 134 for coolers. Dry-storage and office-building cooling loads totalled 350 tons and ice-making another 100 tons.

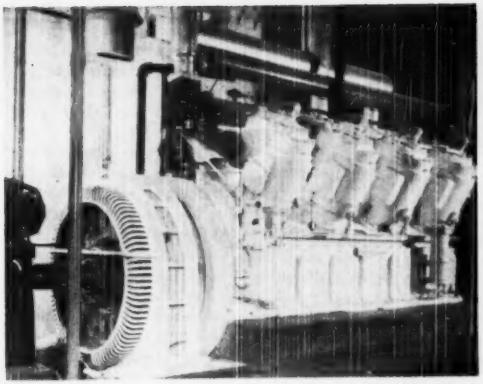
For a plant of this size, ammonia seemed the best refrigerant. Suction lines were long; with ammonia they could be relatively small. Further, oil presented no particular problems and absolute dryness of lines after fabrication was not essential. With an all-welded job ammonia is easy to hold.

Two-Stage System. We felt best operating efficiency and most economical results would come from a 2-stage compression system with liquid cooling for low suction at intermediate suction temperature. Intermediate pressure could also be used for brine coolers and direct-expansion coolers. Ice-making and water-chilling could be served best by a single-stage compressor.

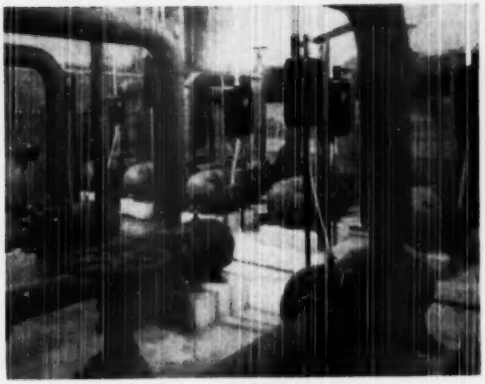
We picked calcium-chloride brine for some coolers where products susceptible to heavy damage from refrigerant leaks would be stored. For balance coolers and all freezers we used direct-expansion ammonia for economies in construction as well as superior performance.

Plant Design. Once we had fixed the load and how we would handle it, we laid out the basic plant design. Suction pressures arrived at were: (1) 0 psig, −28F for low suction from freezers (2) 20 psig, 5.5 F for ice-plant suction (3) 25 psig, 11.3 F for brine-cooler suction and intermediate pressure for booster system (4) 50 psig, 3.8 F for air-conditioning water chilling. To eliminate need for an additional suction pressure and hence further splitting of machines, we selected same pressure for booster discharge, brine-cooler suction and direct-expansion-cooler suction.

Ammonia gas drawn into low-pressure cylinders discharges at 25 psig to an



8 Electric power for entire plant is supplied by three 250-kw generators driven by V-type engines, natural-gas fueled



9 Pump house between cooling towers, Fig. 1, features all-welded piping connections like these on intercooler pumps

intercooler. This also contains a coil for precooling liquid ammonia for freezer rooms. From this point, ammonia discharges to high-pressure ammonia cylinders. Design set 185 psig for discharge pressure. Plant has run somewhat better than this to date with resultant lower head pressure.

Suction Lines. When it came to ammonia suction-line design, we decided to size all lines for a pressure drop not to exceed one psi from extreme end to compressor. While some of these lines are long (one is about 800 ft) we believed there were definite advantages in being able to (1) hold low storage temperatures throughout with uniform evaporator temperatures (2) operate compressors above a vacuum even with freezer temperatures of –10 F.

Because of suction line lengths we had to take special steps for contraction of pipe as well as building changes due to temperature. At intervals of 150 to 200 ft we put in bellows-type expansion joints in the ammonia lines. Joints anchor to building columns and pipe between is guided on roller-type hangers. Brine lines run down each side of the building. They are sized for a total friction loss of 35 ft including brine-cooler friction.

Engine-Room Equipment. There are four main compressors and three small standby units. These standby units also help meet air-conditioning peak loads. Main compressors, driven by V-type natural-gas engines, have horizontal, double-acting ammonia cylinders bolted to the engine side. These cylinders operate through a cross-head from main engine crankshaft to give a compact drive.

Two of the main units, Fig 5, consist of 8-cylinder, 300-hp engines with four ammonia cylinders: a low pressure one with a 15-in. bore by 12-in. stroke and three 9 × 12-in. high-pressure cylinders. The other two units are 6-cylinder 225-hp engines with three ammonia cylinders, Fig 6. One unit has a 15-in. bore by 12-in. stroke low-pressure cylinder and two 9 × 12-in. high-pressure cylinders. The other has three 9-in. high-pressure cylinders.

Engine safety features include cutouts for high water temperature, low oil pressure and overspeed. All ammonia cylinders have high-pressure cutouts connected to the engine safety circuit.

All suction connections into compressor first enter a surge drum. Cylinders similarly discharge into a surge drum to eliminate pulsations and consequent lowering of efficiency. Certain high-pressure cylinders have capacity pockets so they may be used at more than one suction pressure. Bypasses in various suction mains add to operating flexibility.

Three 9 × 9-in. vertical single-acting compressors serve as standbys. They are cross-connected to all suctions for use wherever needed.

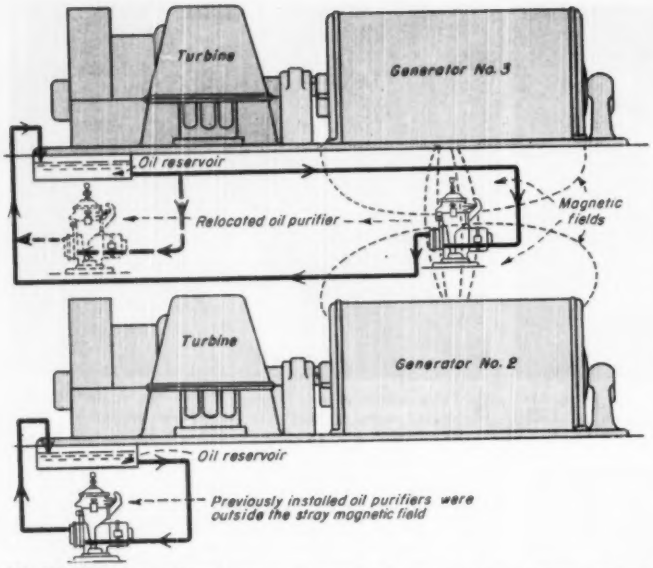
Ammonia Headers. All ammonia mains, ranging in size from 6 to 12 in. in the engine room, are carried in racks along one side, Fig. 4. Headers tie through cross-connection valves. In addition, a pump-out and general utility line is valved to both high and low sides of all ammonia equipment. Main ammonia gages, 8 in. dia, are located at end of main operating aisle. Cold lines are insulated with moulded Fiberglas. Water, gas and air serving engine room mount above central operating aisle and electrical conduits run along opposite wall from ammonia piping. All lines are color coded.

Condensers. Horizontal 4-pass 1000-sq-ft condensers for ammonia service are racked on stands, Fig 7, three condensers high by three wide. These nine condensers provide approximately ten square feet of surface per ton of refrigeration under peak conditions. Each has inlet, outlet, drain, purge and relief valves. Water connections are valved for each condenser and piping is looped to equalize flow to all shells. Two 36-in. by 18-ft receivers, Fig. 7, below the condensers, carry necessary valving and equalizing connections for parallel operation. A foul gas purger, in use at all times, connects to condensers and receivers.

Chillers. Two sets of horizontal multi-pass shell-and-tube chillers are used for brine and chilled water. Coolers are flooded type with ammonia level held through float switch and solenoid valve. Surge drums mounted above chillers protect against liquid surges to compressors. Ammonia backpressure valves on suction outlets of chillers guard against freeze-up from suction pressure fluctuations in equipment. Water-chiller piping permits bypassing coolers for winter operation and picking up hot water from gas-engine jackets.

Cooling towers are outside the engine room. One handles condenser cooling and the other engine-jackets. A pump house, Fig 9, is located between the two towers. Condenser-water tower is a cross-flow, induced-draft design with two fans, capable of cooling 4500 gpm from 91 to 85 F with a wet-bulb temperature of 78 F. Second tower is forced-draft, rated for 1000 gpm of water coming from shell-and-tube coolers connected to engine jackets.

Power for the entire plant is supplied by gas-driven generators, Fig. 8.



OIL PURIFIER bowl showed results of electrolytic action when installed between generators No. 2 and 3. Trouble was traced to stray magnetic fields from generators.

Watch for Stray Fields!

►HERE'S AN OPERATING PROBLEM that's really off the beaten path. It all started when a new 2500-kw turbine-generator set was installed in an existing plant that already had two turbine-generators. One of our centrifugal oil purifiers was placed on the machine floor between turbines No. 2 and 3.

It wasn't long till we noticed the oil purifier's bowl was showing signs of heavy corrosion. As a first step in tracking down the cause a sample of the turbine oil was sent to the oil company laboratory for analysis. Their tests showed it quite neutral.

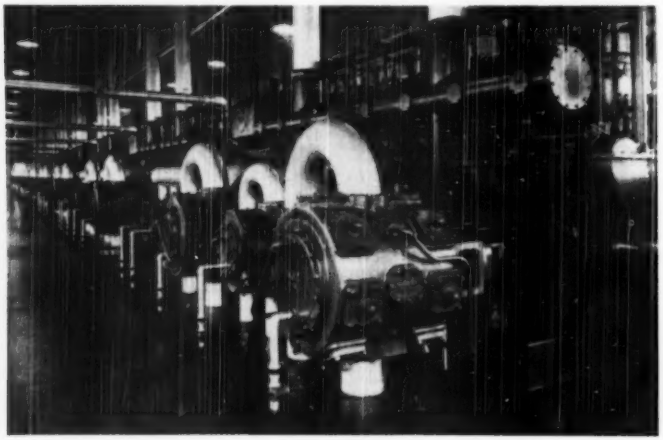
Next step was to take a sample of the separated water, removed from the turbine oil by the purifier, and have it analyzed. That too showed up practically neutral. At any rate the slight acid indication was not enough to cause corrosion.

The above two checks gave the oil and separated water a clean bill of health. So the next logical stopping place was on the electrical side of the fence. A galvanometer connected across a small test coil showed the purifier was located in the path of a strong magnetic field. Apparently this stray field was inducing eddy currents in the purifier. They in turn were responsible for the "corrosive" action.

Now that the cause of the trouble was tracked down our next problem was to re-locate the purifier. Of course we could have followed the pattern already established for the older machines. Their purifiers were located between the turbines. But just to make sure an exploratory test was made, again using the test coil and galvanometer. As was to be expected, little or no magnetic field showed up between the two turbines. This became the final resting place for our oil purifier.

Later checks showed all electrolytic action had stopped with the purifier in its new location.

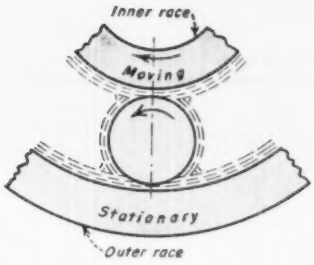
Dick M Landis, Asst Mgr, Industrial Div, The De Laval Separator Co.



SYNTHETIC LUBE

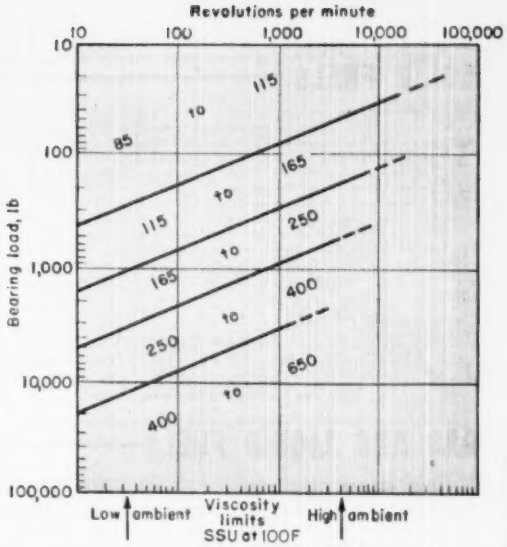
Most of today's applications for synthetic lubricants are in extreme temperature regions. But they're fast finding their way onto the operating floors. For instance, all pressure-lubricated valves on 20 air compressors shown to left are lubricated with a silicone grease. Aim here is to reduce maintenance and frequency of lubrication. Machines are in the Celanese Corp of America plant in Bishop, Texas.

Synthetic lube is also being used in motor bearings. But most such applications are tied in with silicone-insulated windings. This insulation allows operation at higher than normal temperatures, hence calls for high-temperature lube.



OIL FILM in anti-friction bearings cuts rolling friction between balls and races

VISCOSITY LIMITS (right) were established by *Annular Bearing Engineers Committee*



Allowing reasonable amount of "looseness" when selecting oil viscosities for anti-friction bearings, falls in line with the well-founded trend toward using the one lube for many jobs

Being Practical About Oil Viscosity

► THERE IS A BASIC difference in lubrication principle between plain and anti-friction bearings. This fundamental divergence should be understood before discussing oil viscosity in connection with lubrication of anti-friction bearings.

Bearings Requirements. In a plain or sleeve bearing, journal load is supported by a continuous oil film. Maintenance of this film under varying speeds, loads and temperatures is the deciding factor in the selection of the lubricant. But the picture changes with ball or roller bearings.

Anti-friction bearings when loaded have high unit pressures between rolling elements and races. These pressures prohibit formation of an unbroken oil film, hence journal load is supported by the rolling elements and races in metal-to-metal rolling contact. Some deformation takes place in the rolling elements and races.

In view of the above it can be seen that the job of the lubricant in anti-friction bearings is chiefly to provide a thin film to minimize rolling and sliding friction. Furthermore, the lubricant must protect the highly polished surfaces of the rolling elements and races from corrosion. From that point on the role of the lubricant is somewhat common for both anti-friction and plain bearings. That is its job is to remove heat and help keep dirt out.

Friction in a ball or roller bearing will be least when there's just enough oil of proper viscosity to form a thin film over the contacting surfaces. Sizeable increases in temperature or oil viscosity mean more friction. Hence to maintain somewhere near the point of minimum friction, viscosity is important. Also, since viscosity is a function of temperature, the latter must be considered. Bearing speed and loading come into the picture as shown in above series of curves.

Viscosity Recommendation. Curves shown are of value as a guide to oil selection. But note that recommendations are in general terms rather than specific viscosities for each set of conditions. There is good reasoning behind this since in everyday application much latitude is allowable in viscosity ranges.

It is quite true that there are some machines whose design features are mighty critical. And these may operate with closely controlled humidity, ambient and operating temperatures, speeds, loads, etc. In such cases the viscosity variable must be kept within close limits. These cases, however, are definitely in the minority and do not represent industrial applications in general.

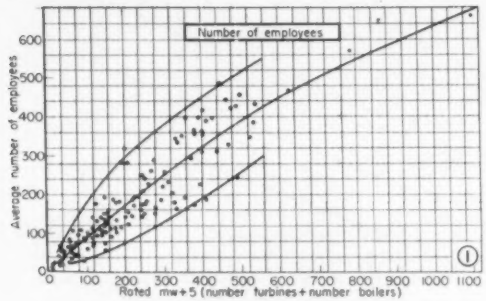
Actually, the majority of industrial applications provide large margins of safety in design of machine elements to meet the practical variations in operating conditions that can be expected. When viewed in this light the latitude suggested in the above chart is understandable. This one point was brought out in a recent paper by John F Pelley ("Gear Lubricants Used in Steel Plants," Technical Publication No. 88, ASTM "Symposium on Industrial Gear Lubricants"). In this paper the author cites the wide divergence of opinion regarding this matter of viscosity determinations. The case in point concerned three mill machines with practically identical tooth pressures and gear speeds. Yet the lubrication needs for these three mills are being satisfactorily met with oils ranging in viscosities from 300 to 4200 SSU at 100 F.

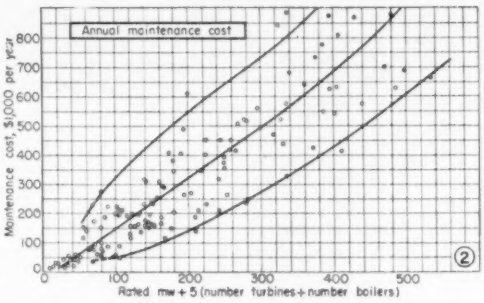
CORRECTIONS

Through a printer's error, the equipment table for the article on Alcoa's Point Comfort Works (p 81, July) omitted Foxboro Co and Mason-Neilan Regulator Co as suppliers, respectively, of gas flowmeters and pressure reducers.

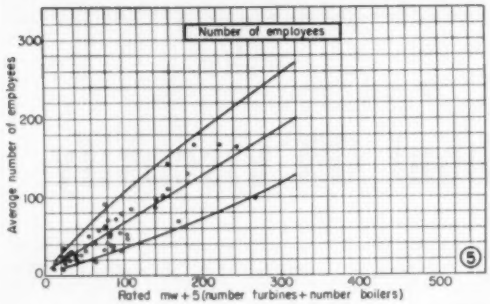
Equipment list for Dow Chemical Co's South Power House (p 81, Aug) inadvertently credited the coal-car shakeout to Robbins & Myers, Inc. This should, of course, have been Hewitt-Robins, Inc.

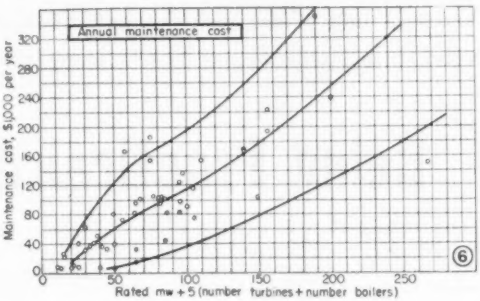
SOLID FUELS





GAS AND LIQUID FUELS





How Does Your Station Stack Up

One of the best ways to tell how well you're doing is to look at results of similar operations. Here are curves presenting experience on over 70 coal-fired and 50 gas- and oil-fired central stations, as reported to the FPC for the year 1947

By D C SWIFT
and
C T WHITNEY

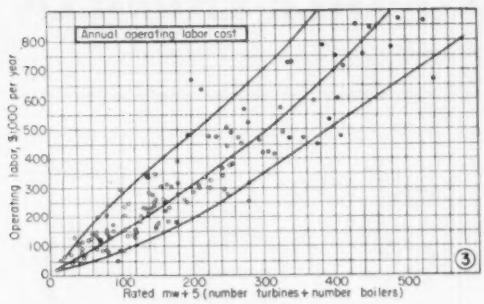
► COMPARING THE PERFORMANCES of different plants calls for discrimination. Just because they have the same capacity is no reason to expect them to incur the same operating costs or require the same number of employees, etc. Many factors have to be taken into account, such as number of boilers in the plant, number of turbines, arrangement of the equipment, geographical location, accessibility to fuel sources, types of fuel burned, prevailing labor costs in the area, and so on.

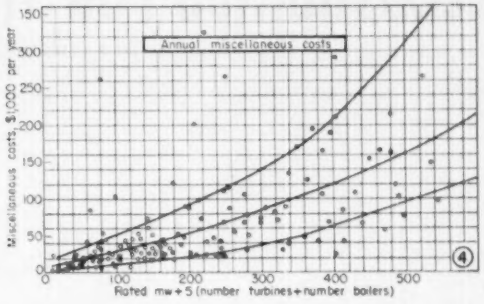
Data Plotted. We have plotted in the nine curves on these pages, four types of operating data: (1) average number of employees, Fig. 1, 5 and 9, (2) annual plant maintenance cost, Fig. 2 and 6, (3) annual operating labor cost, Fig. 3 and 7, and (4) annual miscellaneous costs, Fig. 4 and 8. These are for Class A and B privately-owned central stations during the calendar year of 1947. The data were published by the Federal Power Commission.

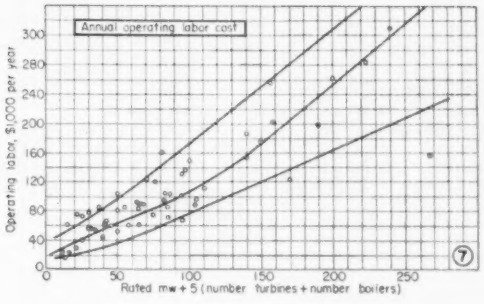
The information has been separated by fuel type: coal-burning plants, Fig. 1 to 4; and gas- and oil-burning plants, Fig. 5 to 8. Note that the data are plotted against an X-axis value having the formula: *Rated megawatts + 5(number of turbines + number of boilers)*. By trial we found this value gave the best correlation. It accounts for both plant capacity and number of units of major equipment in the station.

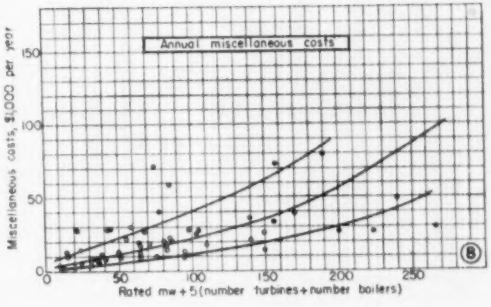
Effect of Adjustment. Comparing Fig. 1 and 9 shows the effect of this arbitrary value. In Fig. 9 the number of employees is plotted directly against megawatt capacity. This results in a much wider scatter of points. By bringing in the factor for number of units of major equipment, the points cluster much closer to each other, as in Fig. 1.

Each graph has a median curve drawn through the points. In addition there are upper and lower curves which might be called "average" envelope curves.









Against Average Performance?

Let's look at some of the median curves. Fig. 1 and 5 for number of employees compare this way:

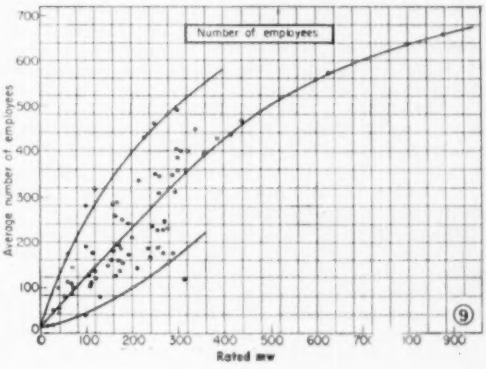
X-Axis	*Solid fuels*	*Gas and Oil*	*Difference*
100	86 men	67 men	19 men
200	168	128	40
300	246	188	58

The fluid-fuel plants show an increasing advantage in minimum crew needed for operation as the plants become larger. Spread in men needed for given sizes is much less among the fluid-fuel plants than for the solid-fuel stations.

Maintenance Costs. Fig. 2 and 6 for annual maintenance cost show considerable scatter over the range of stations. As might be expected, however, the average for solid-fuel-fired plants is higher than for gas- and oil-fired plants. Smaller amount of equipment and less severe service for the latter plants readily explain the difference. These curves should be used with caution. Annual maintenance costs fluctuate with average load and the length of time the units of equipment have been in service, hence they may be expected to vary from year to year.

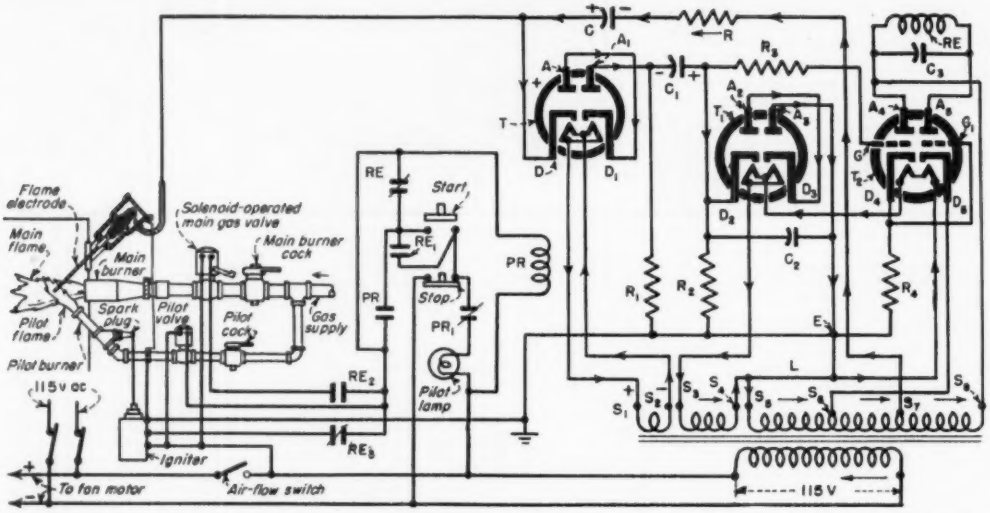
Annual operating labor costs in Figs. 3 and 7 also reflect the lesser equipment needed in gas- and oil-fired plants. Note the "maverick" point in the lower-right region of Fig. 7, showing an extraordinarily low cost for an apparently large plant. This plant has an installed capacity of 67.5 mw, 5 turbines and 35 boilers. Obviously the large number of equipment units makes this point lose some significance.

Annual miscellaneous costs for coal-fired plants, Fig. 4, show a considerable scattering of points in the upper levels.



ELECTRONICS FOR THE POWER ENGINEER

By F A ANNETT, *Associate Editor*



1 Electronic flame-failure detector operates on the flame-conductivity principle. It protects against no-flame conditions, broken or grounded electrode. Electronic circuits use two double 2-element tubes as well as a double 3-element tube

29 — Combustion Safeguards: II

► HERE WE CONTINUE our study of combustion safeguards designed to prevent explosion hazards that develop in boiler furnaces, ovens, heaters and other appliances, pulverized-coal, gas or oil fired. These safeguards operate on three basic principles: flame radiant energy (light), flame conductivity and flame rectification. We will study the first two here.

Flame Electrode. Device of Fig. 1 (The Bristol Co) operates on the flame-conductivity principle. Properly adjusted gas flames show a resistance of between 0.5 and 180 megohms. One end of an electrode (flame rod) is in the pilot flame. Resistance between the electrode and the burner, which is grounded, is measured with an electronic relay.

Three conditions at the burner are possible: (1) When there is no flame resistance is above 180 megohms. (2) When a flame exists, resistance is between 0.5 and 180 megohms. (3) When the electrode has a partial or total short to ground, resistance is below 0.5 megohm. All three conditions are taken care of by Fig. 1.

Electronic Relay. Because of flame's high resistance it is necessary to use an electronic amplifier to operate relays and gas valves of the safeguard equipment. The electronic circuits use two double 2-element tubes (diodes) and a double 3-element tube (triode). The first double diode T serves as a half-wave rectifier to detect presence or absence of flame on the electrode.

Second double diode T_1 extends the upper conductivity range to permit using the equipment where flame conductivity is low. In T and T_1 the two tube sections are connected in series to reduce voltage across each section and increase tube life.

In double triode T_2, left-hand controls input to right-hand half. Latter acts as a power amplifier for relay RE.

Relay Circuits. Let's first study the electronic relay circuits for flame-on conditions. Transformer section S_5S_6 heats cathode of tube T, and section S_3S_4 heats cathode of tubes T_1 and T_2, connected in series. For polarity shown, current flow is as indicated by arrow heads.

Current can also flow from S_7 through resistor R, capacitor C, through tube T, first from cathode D to anode A, then from cathode D_1 to anode A_1. From anode A_1, circuit continues through capacitor C_1, tube T_1, back to S_8 on transformer. Capacitor C and C_1 are charged to polarity shown.

On reverse transformer polarity, capacitor C discharges through R to S_7 and S_8 on transformer, to E, and through ground line to burners. From burners, circuit is through the flames back to C. Capacitor C_1 discharges through resistor R_1 and R_2 in series, also through capacitor C_2, to make its right-hand terminal minus and its left plus.

Capacitor C_1 also discharges through R_3, cathode D_1 to grid G_1, resistor R_3 to C_1. This drives G plus, the conditions required for the right-hand side of the tube to pass sufficient current to close

Universally *Used* and *Recognized*

The six 24" *Walworth* Double Disc Gate Valves shown above are typical of the thousands of various types (Gate, Globe, Butterfly, Plug, etc.) equipped with *LimiTorque Valve Operators*—in daily use throughout the world—on land and sea. So, when we say that *LimiTorque* is *universally used and recognized,* we are making no "overstatement."

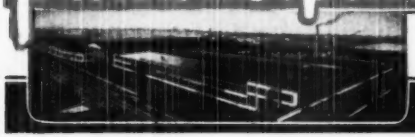
LimiTorque operates by the "push of a button," from either remote or nearby control panel . . . prevents damage to stem, seat, disc, gate or plug, because the Torque Seating Switch *limits the torque, and thereby, shuts-off the motor, before trouble can occur. LimiTorque* also *saves money and promotes safety.*

LimiTorque Controls may be actuated by any available power source: electricity, gas, water, steam, oil, air . . . may be obtained through Valve Manufacturers.

Send for 96-page illustrated and diagrammatic catalog.

Photo courtesy Walworth Company, Inc.

Philadelphia Gear Works, INC.



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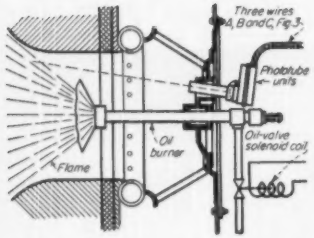
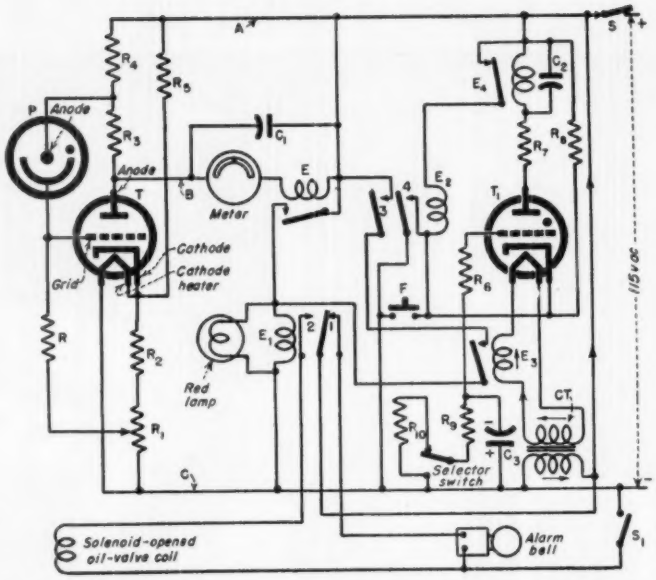
LimiTorque Valve Controls



2 This phototube unit for flame scanning includes an amplifying tube also



3 Diagram of flame-failure protection system that uses a phototube and has electronic time-delay protection during the period when the flame is being started

relay *RE*. When transformer polarity is the reverse of that shown, current flows from S_5 through R_4, cathode D_4, anode A_4 to S_6. Grid G_1 is given a minus bias from S_5 through R_4 to G_1, cathode D_3 to S_6.

When grid *G* has a plus bias, current increases in its side of the tube. This current through R_4 causes a voltage drop that opposes the voltage of transformer section S_5S_6 to reduce the bias on grid G_1.

Grid Bias. Under normal operating conditions enough current flows through R_4 and cathode D_4 to reduce G_1 grid bias to where its side of the tube conducts a current that closes relay *RE*. This circuit is from S_5, cathode D_4, anode A_4, coil *RE* to S_6 on the transformer. Capacitor C_3 acts as a filter across coil *RE* to prevent relay-contact chattering and relay opening during a short interruption.

Previously we said that when capacitor C_1 discharged it changed C_2 so as to make its right-hand terminal minus. When the voltage of C_1 decays below that at which C_2 is charged, the latter begins to discharge through R_4, grid *G*, resistor R_8, to the left-hand side of the capacitor. This helps to maintain a plus bias on grid *G* to keep relay *RE* closed.

Fuel-Burner Control. Now that we have learned how the electronic end of flame-failure protection works, let's see what takes place when we light the burner. This equipment has automatic ignition, a pilot flame and main flame. There is an air-flow switch closed by a vane in the stack. Until this switch closes after induced-draft fan starts, no part of control can be energized. This prevents lighting off fire until furnace has been purged of dangerous gas mixtures.

To simplify the connections, relay contacts have been shown in the most convenient place, away from their coils. Power relay *PR* has two contacts: PR_1 open when relay is dead, and PR_2 normally closed under the same conditions. Electronic relay *RE* has four contacts: two, *RE* and RE_3 normally closed when relay coil is not fully energized, and two, RE_1 and RE_2 normally open under the same condition.

Starting the Flame. Assume that the draft fan is up to speed and air flow in stack closes air switch. When this switch closes, transformer is energized to heat tube cathodes and get this part of equipment ready for lighting the burners. Pilot lamp also lights to show power relay is not energized.

Circuit for this lamp is from bottom power line through stop button, PR_1 contact, and pilot lamp to the top line. Lighting this lamp shows that power is available to start the burner, which is done by closing start button. This completes a circuit through stop and start buttons, contact *RE*, power-relay coil *PR* and to the + line.

Power relay closes contact *PR* and opens PR_1. Pilot lamp goes out, showing that power relay has operated. Closing *PR* contact completes a circuit for the ignition coil's primary through contact RE_3, and the coil to + line. Secondary of this coil connects to the spark plug in the pilot burner and through it back to ground terminal on coil. Pilot gas valve is also energized through contact *PR* to the + line. This valve opens and spark plug starts pilot flame.

When pilot flame starts, it contacts flame electrode which causes electronic equipment to function as previously explained and closes relay *RE*. When this relay operates, it opens contacts *RE* and RE_3 and closes RE_1 and RE_2. Closing contact RE_1 bypasses the pushbutton so it can be released and the operating circuits remain energized.

Closing RE_2 completes a circuit for the main gas-valve coil. This valve opens and main burner lights. Opening contact RE_3 takes ignition coil out of service, because it is not required. But pilot flame remains lighted.

No-Flame Conditions. If for any reason the flame goes out, capacitor *C* cannot discharge. Because *C* cannot discharge it becomes fully charged, remains that way and cannot pass current through tubes *T* and T_1. So, grid *G* of tube T_2 loses its plus bias and grid G_1 is biased minus enough to open relay *RE*. This relay opens contacts RE_1 and RE_2 to break power-relay and main gas-valve coil circuits. Opening of power relay closes contact PR_1, and pilot lamp lights to show burners are out.

If electrode were to break, effect would be same as flame going out. Equipment would function to close fuel valves. In this case, however, if a trial is made to start flame, main gas valve cannot open and pilot flame will remain ignited only as long as start button is held closed. Relay *RE* remains in-

(*Continued on page* 152)

HOTTER, SOONER steam traps..
knock cold spots out of platens

Cold spots in press platens at this large western plywood plant are a thing of the past since they've installed the steam traps that get equipment *hotter, sooner*—Yarways.

Yarway Impulse Steam Traps never allow condensate to accumulate and pull down working temperatures. They discharge the condensate *as fast as it forms.* Result—equipment always operates at highest efficiency.

Couple this fact with other features like small size, easy installation, only one moving part, non-freezing, good for all pressures, low cost—and you know why more than 650,000 Yarway traps have already been installed.

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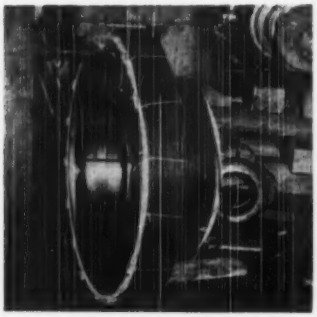
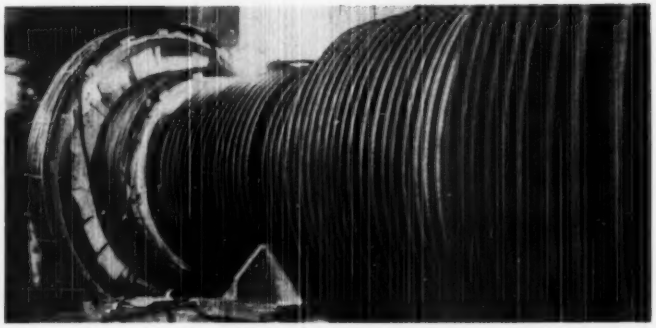
POWER ENGINEERS' NOTEBOOK

PLANT-TESTED IDEAS TO SOLVE PROBLEMS OF DESIGN, OPERATION AND MAINTENANCE





NEW BALANCE PISTON REDUCES STEAM-TURBINE VIBRATION

Our 10,000-kw reaction condensing steam turbine, using 250-psig, 600-F steam, had a long history of erratic vibration. It always went up to synchronous speed without any vibration. Once on the line, though, every load change caused excessive vibration. A year ago both spindle and alternator field were balanced dynamically, but no operating improvement resulted.

Looking through the records we discovered that the balance piston was shimmed in 1940. It seemed that the piston had grown again since. It probably loosened up at certain temperatures, though it was tight when cold.

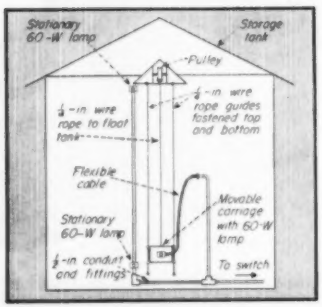
We ordered a new alloy piston from the factory. Last April the turbine was dismantled. We removed the old piston with a hydraulic press. It came off easily. The piston showed signs of having been loose. Shims installed in 1940 were badly corroded and cut.

With the piston off, we found the high-pressure blade ring was looser in fit than the piston. We had no replacement ring, so the entire ring, with blades in place, was removed and shim stock pinned to the inside with flat-head countersunk machine screws. The shims were not pinned to the spindle because they would expand and buckle when coming in contact with the hot blade ring and might cause trouble.

To heat the balance piston before placing on the spindle, it was first wrapped with asbestos paper. Strips of wood placed at intervals on the circumference supported 59 turns of No. 4 wire. This coil drew about 100 amps at 110 v, 60 cycles. The piston was induction heated very slowly by turning the current on intermittently during a period of 16 hr, left-hand sketch above. It was kept covered during this time. The right-hand sketch shows the piston pressed in place on the spindle. We found the turbine much improved when we put it back in service though bearing clearances may need adjustment.

A R Eastcott Princeton, B. C.

LIGHTS SHOW LEVEL IN EMERGENCY WATER TANK CLEARLY



We found it economical to use a high hill some distance from our plant to support an emergency water tank. The distance made it difficult to see the level marker, even in daylight. As a result the tank reached dangerously low levels quite frequently. We finally solved this condition as shown in the sketch at left.

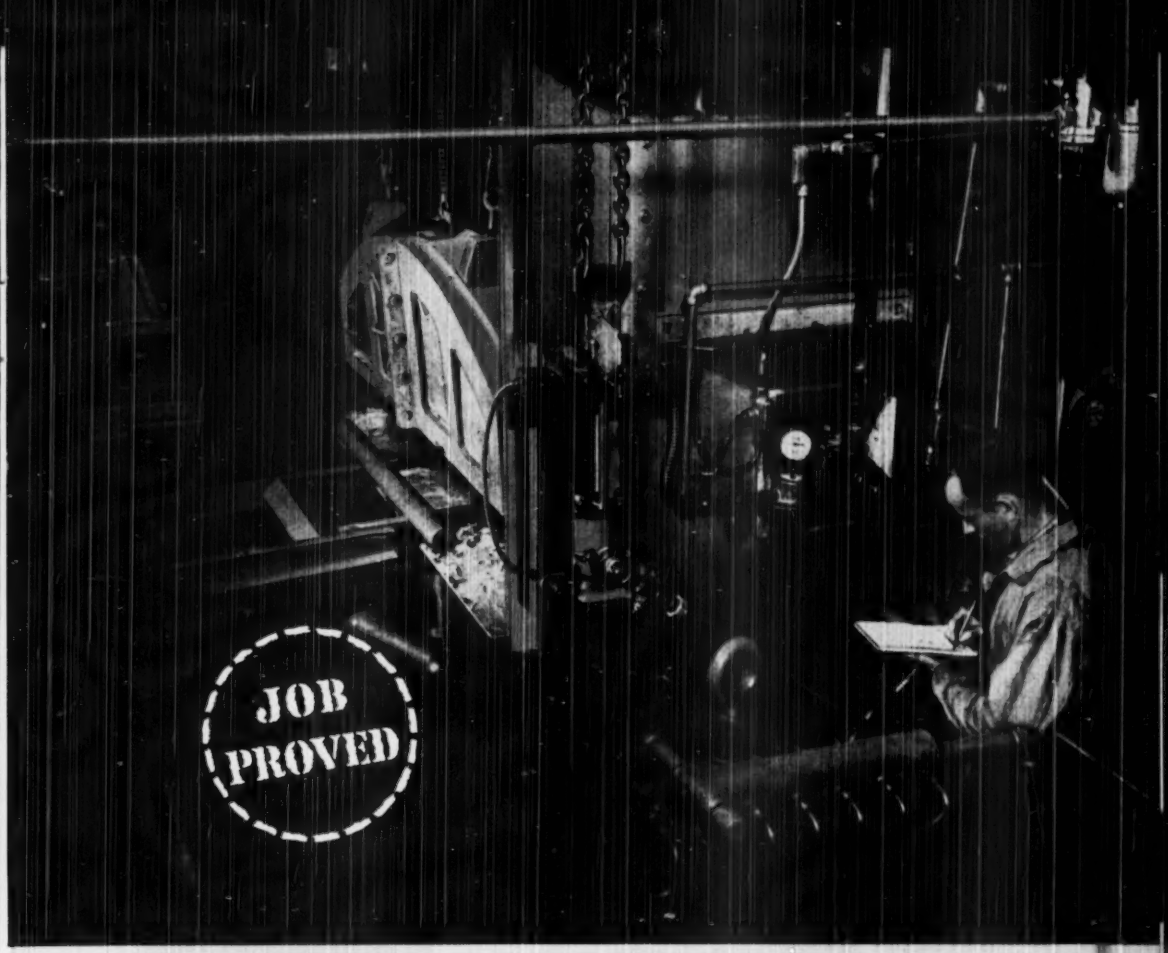
Two stationary 60-watt lamps were placed near top and bottom of tank and above each other. In place of the original marker we installed a moving carriage operated by the float with a third 60-watt lamp. Now, level can be easily seen, day or night.

J A Swanson Princeton, B. C.

(*Continued on page* 126)

HOW ABOUT YOUR IDEAS?

POWER pays $20 for each item published in this department on problems in design, operation and maintenance. Your manuscript need give only the facts, with sketches in pencil. We'll dress it up.



HYDRAULIC SYSTEM KEPT LIKE NEW

Sunvis 916 Effects Substantial Savings; Strainers and Lines Kept Sludge-Free

A copper tubing manufacturer uses an oven with hydraulically operated doors to heat billets to approximately 1550F. The ambient temperatures around the hydraulic mechanism are abnormally high, putting the hydraulic fluid to a severe test of stability. Failure of the system would halt the piercing operation and result in costly delays throughout the plant.

Since the oven was first put in operation, three years ago, the hydraulic fluid has been Sunvis 916. The original charge has never been changed and is still in excellent condition, though the system is tight and requires only a minimum of make-up. Oil lines and strainers are completely free of sludge. Seals and packings are sound. Operations are never interrupted for oil changes or parts maintenance. The company expects to retain the original charge of Sunvis 916 in service indefinitely, effecting large savings in both oil and maintenance costs.

Sunvis 916 is a solvent-refined oil of the highest quality. It is fortified to resist the oxidation and sludging so detrimental to the efficient operation of hydraulic systems. Sunvis 900 Oils are *good for the life of your machines*. For your copy of the illustrated booklet "Sunvis 900 Oils" write Department P-9.

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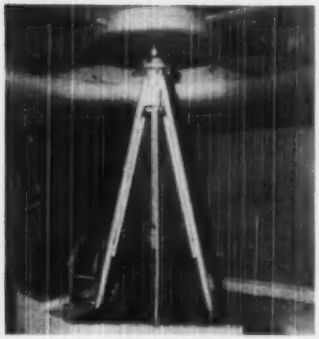
 Continued from page 124

SIMPLE ARRANGEMENT SHIELDS COOLING-TOWER FAN SHAFT



Even though enclosed within the cooling-tower structure, and usually protected in addition by a locked gate, the two rotating shafts between motor and fan form a very real hazard. They are dangerous to personnel during periodic lubricating operations as well as to possible unauthorized persons entering the enclosure.

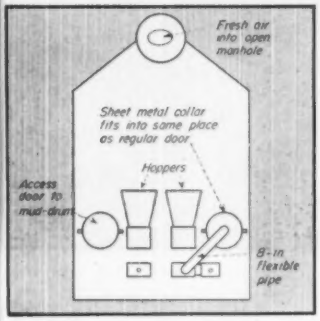
One plant protects its cooling-tower fan drives with more than the customary shield or grille covering the flexible coupling between motor and bevel-gear drive. The picture, left, shows how three pairs of ears are welded to each leg of the tripod supporting the upper shaft bearing. These serve as anchors for shields of expanded metal bolted to them. These three shields fill the triangular spaces between the tripod legs from top of the gear box to the base of the upper bearing.

The shields leave plenty of space for inspection of the rotating shafts and universal joints. Openings are left where space is needed to check local lubricating conditions.

The shields have the advantage of ease of installation, good appearance and are easy to maintain. They are removed by releasing the bolts.

Elton Sterrett Houston, Texas

STACK DRAFT REMOVES DUST DURING BOILER-TUBE CLEANING


Fresh air into open manhole
Sheet metal collar fits into same place as regular door
Hoppers
Access door to mud-drum
8-in. flexible pipe

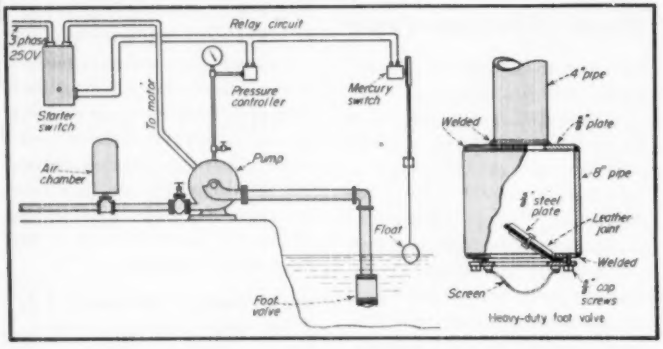
Our water-treatment method leaves a slight mud deposit in the lower ends of our 2-in. boiler tubes. We clean these out with our air-driven tube cleaner during the annual boiler overhaul. This raises considerable dust in the boiler interior and out in the boiler room.

To eliminate this nuisance and dispose of the dust we decided to utilize the natural stack draft. We made up a rig from an 8-in. metallic flexible pipe and two collars. One collar fits snugly into the mud-drum openings and the other into the ash hopper observation door, as shown in sketch at the left.

The collars are made so that the pipe can swivel within them. This allows using the rig on either the left or right side of the mud drum. When used, the upper-drum manhole is left open. The man cleaning the tubes is working within this drum. All other boiler openings are closed except the mud-drum manhole connected to the furnace through the rig. Only a slight opening of the uptake damper sets up a strong air circulation carrying all the dust into the furnace and up the stack. This also provides good drum ventilation.

K S Shepherd Hamilton, Ont.

DIFFERENTIAL-PRESSURE CONTROL PROTECTS CENTRIFUGAL PUMP



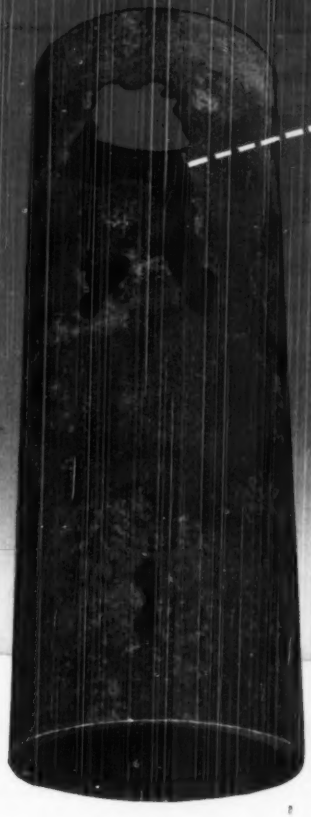
A 5x6-in. duplex pump in our coal mine had to be removed for repairs. As a substitute, we had a centrifugal pump which we installed to work against the 135-ft lift. We ran into some operating grief when the pump lost its prime and ran dry for several hours. The clearance rings were badly scored and had to be renewed. The prime was lost through the packing glands. The original cast-iron foot valve was cracked, which we replaced with a built-up unit shown in the sketch.

The foot valve was arranged to act also as a check valve so that the pump would always be primed under the full 135-ft head. If the prime should be lost despite this head, we set up the protective arrangement shown in the sketch.

An ordinary differential-pressure single-pole control switch was connected in series with the float-controlled mercury starting switch. The pressure diaphragm connects directly to the top of the pump casing. The control cuts out at 15 psig and in at 25 psig. If the casing pressure drops below 15 psig the switch prevents the motor from starting. Seven months continuous duty has proved this scheme as adequate.

D J Breton Drumheller, Alberta

Prevent Return Line Corrosion ....



with

FILMING AMINES

HERE'S AN exciting *new* development in the Water Conditioning Field!

Corrosion of steam and condensate return lines is a serious problem to most industrial plants. Such corrosion is caused by the presence of carbon dioxide and oxygen. Up to now, it has been the usual practice to neutralize the carbon dioxide. However, the high cost of this neutralization method has limited its application. And, no protection against oxygen corrosion is assured.

Betz Laboratories have developed a new, advanced process for the prevention of return line corrosion employing *octadecylamine*. This material *does not* neutralize the carbon dioxide. Instead, the amine is adsorbed on the metal surfaces in a monomolecular non-wettable film which acts as a barrier between the metal and the condensate, protecting against both oxygen and carbon dioxide attack. The monomolecular film does not increase in thickness with continued treatment. Results? As high as *99 percent reduction* in corrosion rate has been achieved!

Let a Betz Field Engineer show how you can cut costs in your plant with the use of filming amines. Write today! There's no obligation, of course. W. H. & L. D. BETZ, Gillingham & Worth Sts., Philadelphia 24, Pa. In Canada: BETZ Laboratories, Limited, Montreal 1.

Send for Betz Technical Paper #120, "How Filming Amines Prevent Steam and Return Line Corrosion".

*U. S. PATENT 2,460,259

BETZ

BOILER WATER CONDITIONING • COOLING WATER CONDITIONING • INDUSTRIAL WASTE TREATMENT

PROBLEMS FROM THE PLANT

THIS MONTH'S QUESTION: What Causes Hammering in Condensate Line?

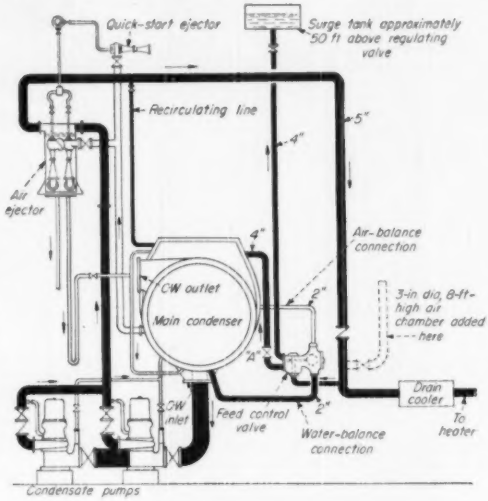
Condensate level in the surface condenser for our 15,000-kw turbine-generator is controlled by a float valve; see sketch. This valve connects to condensate-pump discharge line and feedwater-pump suction. When feed pump doesn't need condensate it is passed through float valve to surge tank. When condenser needs makeup, valve feeds it from surge tank. Now here's our problem:

During makeup to condenser there is severe water hammer in condensate-pump discharge line. We also get bad hammering during a slight change in vacuum. Besides, float drops to makeup position when vacuum changes.

We've dismantled the valve and checked it for sticking but it works freely. We installed an air chamber on condensate-pump discharge but this didn't stop the hammering. When hammering first started we would move the float a bit and noise would stop. But moving the float now doesn't do any good.

The only way we can now stop hammer is by throttling valve A, sketch. When open more than one turn there is loud hammering. We know this valve should be wide open when turbine is operating.

Can any POWER readers give us sketches and methods for eliminating this hammer? Everyone in our plant has tried but no one has come up with the right answer.—LN



Exercise your engineering wits by submitting answers to this question, fresh from the plant. Suitable material will be paid for: answers accompanied by sketches or photographs command additional pay

Readers Answer the June Question

Can We Burn Waste Wood and Bunker C?

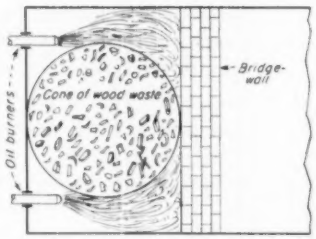
(This question from June issue is followed by best answers from readers.)

WE ARE AT THE PLANNING STAGE *on a new heating boiler to burn waste wood and fuel oil. Dry-wood shavings and spruce and jack-pine shreddings will account for up to 20% of total fuel required. Remainder will be bunker-C oil. Boiler will have a dutch-oven setting with the oil burner placed in the bridge-wall.*

Our proposed packaged-type water-wall boiler will have a nominal rating of 8000 lb per hr. It will be designed to work at 200% of nominal rating in winter, to produce 12,000 lb of steam at 80- to 100-psi working steam pressure.

Now here's our problem. We hear it is unwise to combine wood and oil fuels in one boiler. Reason given is we may get a deposit of fused wood-ash on the convector tubes at points where temperatures may be higher than average.

We certainly will value the opinion and experience of POWER's *readers on whether we are running a risk in combining these fuels. Then, again, is there any more likelihood of these deposits forming with the oil and wood combination than with the combination of nut slack coal and wood fuel?*—WH



He's Done It

IN OUR PLANT, a West Coast pulp mill, we burned wood waste and bunker-C oil for many years without serious difficulty. We had a dutch oven to which wood waste was fed from the top by conveyor and chutes. It formed a cone on the grates below.

Two oil burners were placed in front wall so flames were on each side of cone, see sketch. Air flow resistance through grates is least around outer circle of cone. Place oil burners above it to reduce stratification and improve efficiency by utilizing excess air present. Blow soot twice a shift to remove ash deposits. Do not allow oil flames to impinge on furnace wall.

J A SWANSON *Princeton, B. C.*

Three Pointers

FOR GOOD COMBUSTION of wood and oil *WH* should watch:

1. Grates, unless water cooled, must be protected from oil burner radiant-heat

2. Keep air velocity through wood grate low to prevent carryover of dirt particles. This is important because dirt can flux with solids which may be in an oil as heavy as bunker C. Wood fuel

"WATCH-DOG" ...for Bleeder Lines

GUARDING expensive turbines from bleeder back-flow damage demands a check valve that works *every* time. That's why it pays to come to specialists in power equipment for the valves to fill your "watch-dog" chores.

In the installation above, the turbine bleeder line supplies low-pressure steam for boiler feed water heating. The oil or air operated Swing Check Valve in the bleeder line gives *positive* protection against back flow of condensate, water leakage, or low-pressure steam. The valve's full-flow design and precision seating give a bonus of efficiency and lower pressure loss.

The SK Bleeder Line Check Valve is typical of the *standard* power equipment which Schutte and Koerting has been manufacturing for over sixty years. In addition, SK engineers stand ready to help you with your *unusual* power control problems —by either adapting *standard* items, or engineering *special* equipment to fit your job.

Write for Bulletin 8-K on SK Bleeder Line Check Valves, or for engineering assistance on your special power problems.

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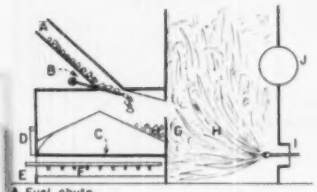
JET APPARATUS • HEAT TRANSFER EQUIPMENT • STRAINERS • CONDENSERS AND VACUUM PUMPS • OIL BURNING EQUIPMENT • ROTAMETERS • FLOW INDICATORS • RADIAFIN TUBES • VALVES • SPRAY NOZZLES AND ATOMIZERS • GEAR PUMPS • DESUPERHEATERS

floated through salt water often causes serious slagging in West Coast area. Fuel from fresh water generally doesn't slag. Never expect to evaporate more than 20 lb per sq ft of grate per hr if carry-over is to be avoided.

3. Expect rather low CO_2 when oil is burned alone in a furnace fitted with a dutch oven. Some firms, when they expect to operate on oil alone for a long time, completely brick off dutch-oven furnaces at bridgewall to reduce excess air.

R B Boals *Eugene, Oregon*


A Fuel chute
B Flash-back damper
C Grates (can be watercooled with feedwater)
D Clean-out door
E Spray pipe to wash ashes from under grates
F Ash disposal and air duct to grate
G Bridgewall
H Combustion chamber
I Oil burner and air register
J Lowest drum or header

Everybody Does It Here

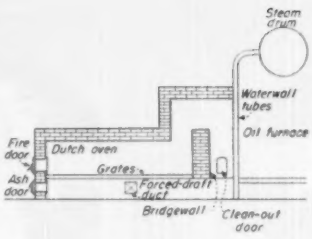
Many central stations and practically all sawmills and paper mills in the Pacific Northwest burn bunker-C oil with waste wood. Design of dutch oven and combustion chamber must be right for good results.

If his oil flame is far enough from heating surface for complete combustion, *WH* will find less carbonized oil on tubes than when burning oil alone. Flyash and cinders continually scrub carbon off tubes. There will be normal problem of handling ash and cinder where it settles between passes in boiler. Use soot blowers or lances, or both, for removal.

Make allowance for increased draft required for burning wood and supply enough air for oil burners. If burners are in bridgewall, I assume they will be stationary. With steam or air atomization, burners will be cool during periods when only wood waste is burned.

Some thought might be given to locating burners in a more handy place so they are removable when not in use. See sketch. Mechanical atomizers might be more practical to use because flame is shorter. They are economical and prevent steam leaking into combustion chamber where it condenses on tubes during downtime.

C M Beck *Camas, Wash.*



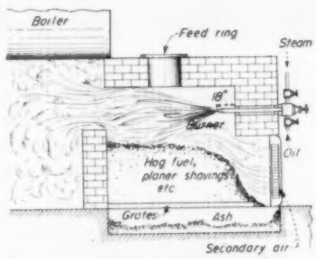
Eliminate Flyash

For many years I fired a combination oil-burning and wood-burning boiler. I found you can carry one-quarter load with wood refuse, remainder with oil. Install a forced-draft system for dutch oven if it is possible.

Also, use a flyash collector. There will be large amounts of flyash. If it does not interfere with production, leave collector off.

Install cleanout-door back of bridgewall, see sketch. It will be helpful. Door at each end of bridgewall helps keep flyash off oil-burning furnace floor. Clean oil-burning floor and back of bridgewall every 8 to 12 hours. Flyash reduces combustion space in oil furnace.

B D Riley *Brunswick, Ga.*



Locate Burner Properly

In our region we have an abundance of wood waste. We burn hog fuel, planer shavings, sticker dust, cedar wool, bark and yard sweepings in a dutch oven. When sawmills shut down at Christmas, during cold weather and fire season, we must burn oil.

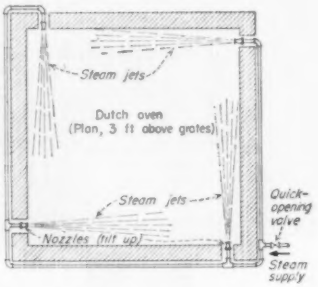
Our boiler is a 1640-sq-ft hrt, 18 ft x 72 in., with a steam-atomizing burner in front wall midway between grates and arch. We burn an average of 60 gal per hr of bunker-B. By feeding water-soaked wood refuse into oven with oil, consumption drops to 30 gal per hr.

To get good combustion, feed wood fuel into feed ring to eliminate a cone in center of oven. Bar waste so it is 8-in. below burner tip. Keeping wood level prevents flame deflecting against arch. It also prevents sawdust sparks being carried over into combustion chamber.

Open stack damper wide enough to create turbulence in combustion chamber. Leave front doors open slightly to supply more air to oil burner and reduce stack smoke. In operating with two fuels, we never had any fused deposits on setting or tubes.

I advise *WH* not to have oil burner in bridgewall because oil slag may deposit in combustion chamber. Not even a target wall will prevent it. Extending burner about 18-in. through front wall will drop this slag into the wood refuse, forming soft clinker on grate. See sketch. This is easily removed daily with a hoe. If *WH* burns only oil with this setup, efficiency will be low because interior of dutch oven is a bright cherry red all over.

F R Faucett *Vancouver, B. C.*



Handle With Care

I suggest that with 80% of his steam load generated by fuel oil he control his wood-fuel feed rate. Attendant then varies feed as needed and keeps wood combustion rate in line with its production. With oil carrying large part of steam load, it can be regulated by steam-pressure actuated regulators.

By using positive feed for wood waste he reduces likelihood of feed interruptions. Keep plenty of oil flame to ensure quick and safe ignition if wood feed fails. Remember, you're feeding an explosive material much like gas. Guard against accumulation of unburned wood in setting. If it explodes it is a danger to life and property. *WH* can burn wood safely but must be constantly vigilant.

Ash fusion is prevented by giving a swirling motion to combustion gases. Use either multiple oil burners or steam jets as in sketch. Tilt jets slightly and discharge a short distance above high-heat zone in furnace. Jets reduce smoke and improve combustion.

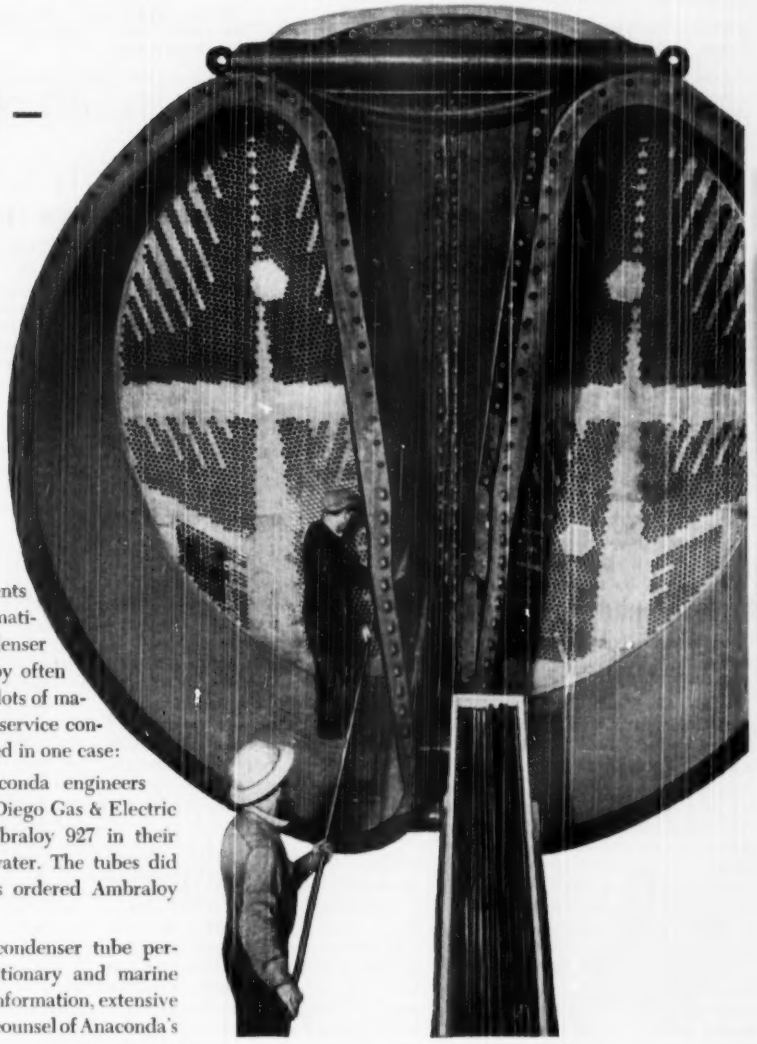
H B McDermid *Norwood, Ohio*

(Continued on page 222)

how to be right –

6,100 times!

INSTALLING 6,100 TUBES *of Ambraloy 927 in the No. 3 condenser of the Silver Gate Plant of the San Diego Gas & Electric Company, San Diego, Calif. This Worthington Condenser serves a 50,000 kw. General Electric Turbo-Generator. It has 38,000 sq. ft. of condenser surface and can handle 620,000 lb. of steam per hour.*



Many power plant requirements can be supplied with mathematical precision. But not condenser tubes. To pick the right alloy often takes lots of experience with lots of materials under many different service conditions. Here's what happened in one case:

Thirteen years ago, Anaconda engineers recommended that the San Diego Gas & Electric Company use tubes of Ambraloy 927 in their condensers cooled by salt water. The tubes did so well that this utility has ordered Ambraloy 927 for other installations.

We have a vast file of condenser tube performance data on both stationary and marine installations. This wealth of information, extensive laboratory facilities and the counsel of Anaconda's Technical Department engineers are at your service. Call us any time, and meanwhile make sure Anaconda Publication B-2 is in your files. Write The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

for efficient heat transfer

ANACONDA® CONDENSER TUBES

TECHNICAL BRIEFS

ENGINEERING DEVELOPMENT HERE AND ABROAD DIGESTED FOR BUSY POWER MEN

REVIEWED IN THIS ISSUE

UNDERGROUND POWER: Underground Hydroelectric Plants • Underground Hydroelectric Power Stations in Sweden

WATER TREATMENT: Chemical Removal of Copper from Boilers

STEAM GENERATION: Cyclone-Fired Pressurized Steam Generator • Knox Lee Power Plant's Pressurized Boiler • Actual Temperatures Reached by Underfeed Stoker Iron

PROCESS HEATING: High-Temperature Fluid Heating

SMOKE PREVENTION: Electrostatic Collection of Flyash • Mechanical Dust Collectors • Measurement of Smoke with a Photoelectric Cell

AIR CONDITIONING: Operating and Maintenance Experience Based on Performance of Steam-Absorption Refrigeration • Summer Load Building

Directions for ordering papers are given on page 134

REPRESENTATIVE UNDERGROUND HYDROELECTRIC POWER PLANTS

Plant	Country	Installed or design capacity, kw	Gross head, ft	Turbines	Volume of powerhouse cavity, Net cu yd	Volume of powerhouse cavity, Total cu yd	Powerhouse, net cu yd per kw	Initial operation, Year
Porjus	Sweden	60,000	183	8, Francis, hor	35,000	41,000	0.58	1910
Brommat	France	186,000	855	6, Francis, vert	60,000	76,000	0.32	1932
Innertkirchen	Switzerland	210,000	2235	5, Pelton, vert	59,000	79,000	0.28	1942
San Giacomo	Italy	200,000	2140	3, Pelton, hor	37,000	[2]42,000	0.19	1948
Provvidenza	Italy	150,000	838	3, Francis, hor	44,000	[2]47,000	0.29	1949
Lavey	Switzerland	72,000	130	3, Kaplan, vert	—	—	—	1950
Handeck II	Switzerland	114,000	1518	4, Pelton, vert	39,000	—	0.34	1950
Harspranget	Sweden	377,000	346	4, Francis, vert	—	—	—	1951
Santa Massenza	Italy	284,000	1505	—	—	—	—	—
Monte Argento	Italy	66,000	164	3, Francis, vert	21,000	[3]29,000	0.32	1952
Montorio	Italy	100,000	845	3, Francis, vert	29,000	30,000	0.29	—
Verbano	Switzerland	100,000	973	4, Francis vert	[4]33,000	—	[4]0.33	1952

[1]Plus: Entrance tunnel ..... 54,000 cu yd
Bush shaft ..... 31,000 " "
Substation tunnels ..... 67,000 " "

[2]Plus: Entrance tunnel, 29,000 cu yd

[3]Plus: Entrance and bus tunnels 3600 cu yd

[4]Preliminary design

Underground Power

UNDERGROUND HYDROELECTRIC PLANTS, *by Paul E Gisiger, Companhia Brasileirila Administradora de Servicos Tecnicos, Sao Paulo, Brasil.* In recent years a number of underground hydroelectric power stations have been built, mostly in Europe, and many others are now under construction. While the last war undoubtedly had some influence in making substantial protection of generating facilities desirable, this paper points out that underground stations had been built long before the war, and under certain circumstances there may be valid technical and economical reasons for the choice of this construction.

Advantages that may result from underground location are discussed and attention called to features that need special attention in the design, such as access and safety, insulation and ventilation. Several representative underground plants are discussed and are also listed in the table.

Underground powerhouses have almost become the rule rather than the exception for new developments in many sections of Europe. A considerable number are now under construction. Among the more notable ones are Harspranget plant in Sweden, just completed or about to be completed, with installation of 285,000 kw; Kilforsen plant, with 240,000 kw, also in Sweden, to be completed in 1954; the Santa Massenta and Provvidenza plant in Italy, with 284,000, and 150,000 kw, respectively, and the Bermano plant in Switzerland about to be started with 100,000 kw. *AIEE paper No.* 50-186.

UNDERGROUND HYDROELECTRIC POWER STATIONS IN SWEDEN, *by Ake Rusck and G Westerberg, Swedish State Power Board.* There is no general rule to decide whether a station should be underground. Wherever an underground station has been built in Sweden it was the most economical solution for the problem. Improved safety in time of war was only an extra advantage and not the primary reason.

Cost of underground power stations, recently built or now under construction, is about $80 per kw maximum output per station with capacity of 100,000 to 300,000 kw. This is based on 1949 price levels at an exchange rate of $1 per 5.18 Swedish croner, author says.

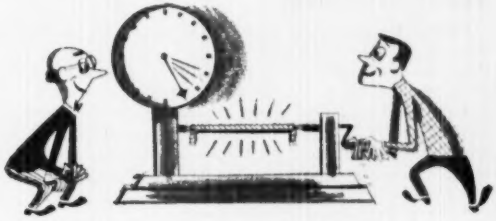
When comparing underground and surface power stations, maintenance costs for tunnels and rock walls and roofs are lower than for the corresponding cost of a surface station where concrete is used to a greater extent. This is also true of depreciation as rock has far longer life than concrete, Sweden reckons on an annual maintenance cost and depreciation of 1% of the construction cost for rock work, while the corresponding figure for concrete is 1.7%.

The authors say operation of an underground station does not differ essentially from that of a surface plant. There are no direct disadvantages in operating and maintaining an underground station in comparison with a surface plant. In large stations two operators are normally on duty during each shift, whether the station is above or below ground.

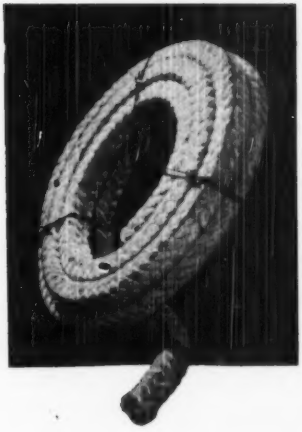
No staff difficulties have been experienced. An operator in an underground station naturally does not see the sun during his shift, but apart from this there should be no difference between working in an underground or surface plant. An advantage underground is that climatic conditions are more con-

From prehistoric times, ramie fiber has been known for its greater strength . . .

Now. . . Johns-Manville makes it into a packing of greater strength



That's why *NAVALON* lasts longer than other cold-liquid packings



LONGER PACKING LIFE . . . less down time . . . lower packing costs . . . it's the same story wherever this new Johns-Manville packing made from ramie is being used in cold liquid service.

And no wonder! Navalon has the high tensile strength inherent in ramie, strongest of all the organic fibers. It has the long-lasting, rot-resisting qualities for which ramie has been known for centuries. And it is made by an exclusive Johns-Manville process which imparts unusual lubricating properties as well—another reason why Navalon consistently outperforms other high quality packings in service against fresh and salt water, brine, cold oil and many other liquids.

If you have a tough packing problem in your plant . . . need a packing that will stand up and take it when other packings let you down, we suggest you give Navalon a try.

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POW-9

stant. It is possible that psychological factors may have some influence, but such difficulties have not been experienced. As proof of this, there has been no noticeable tendency among operators in underground plants to apply for discharge or transfer to a surface station. Operators have the same working hours, holidays and social advantages as those in surface stations. *AIEE paper No. 50-149.*

Water Treatment

CHEMICAL REMOVAL OF COPPER FROM BOILERS, *by R G Call and W L Webb, American Gas and Electric Service Corp.* Acid cleaning of boilers has become a widely practical operating and maintenance tool. Lately considerable attention has been called to formation of iron-oxide deposits. Here is a report of still another deposit problem.

When acid cleaning a 1,000,000-lb-per-hr boiler in one of the authors' properties with a 5% inhibited hydrochloric acid a conditioning boil-out solution of 0.25% sodium chromate was employed. Several sample tubes were tested. Deposit had an average copper content of about 52% and an average weight of 125 grams. It covered all surfaces and had become partly detached.

Shortly after the boiler went back into the service it experienced a forced outage. During this outage drums and lower headers were found to contain much dislodged sheet copper.

Because laboratory tests on previously used copper solvents gave poor performance, a solvent was developed containing ammonium persulfate, ammonium hydroxide and caustic soda. When it was used on the 1,000,000-lb-per-hr boiler it took out about 300 lb of copper.

The authors give laboratory procedures, field cleaning procedures, results and costs. They then express the hope that this paper will stimulate further investigation of all phases of the problem. Their present method they feel to be too costly. *ASME paper. No. 50-SA-34.*

Steam Generation

A CYCLONE-FIRED PRESSURIZED STEAM GENERATOR, *by Merle Newkirk, Dow Chemical Co.* Based on experiences the author's company had with their cyclone-fired pressurized units, he believes present coal-fired steam generators can be greatly improved.

These improvements could be (1) no need to pulverize coal (2) use of coals formerly too uneconomical to prepare (3) better arrangement of heat-absorbing surfaces with cleaner combustion (4) bottom support for the entire structure (5) a hot-air turbine to supply combustion air (6) a circular steam-generator form that lends itself more readily to semi-outdoor installations and makes for easier construction (7) an opposed firing system that will simplify ash disposal.

Paper contains a comprehensive description of the first industrial application of cyclone burners. Many of the design requirements are given. Further charts are given of the dust-loading tests and the performance of the boiler units.

Dust-loading tests run by Dow Chemical include soot blowing, which is not often found. Their tests indicate a performance well below the emission standards set by the Pittsburgh ordinance: 1465 grains per 1000 cu ft at 32 F. *ASME paper. No. 50-SA-38.*

KNOX LEE POWER PLANT'S PRESSURIZED BOILER—A NEW TREND IN STEAM GENERATION, *by J Robert Welsh, vice-president, Southwestern Gas and Electric Co, and L Skog, Jr, mechanical engineer, Sargent & Lundy.* Prime purpose of this paper is to discuss the special features in design and construction of steam-generating units to operate with furnace under pressure. This, of course, eliminates the induced-draft fan. Advantages of such operation are discussed and outlined.

Material and erection labor costs of steam-generating units increased when changing to pressure operation of the furnace. This came about because a pressure casing had to be added and the tubes changed to close spaced or stud construction.

But the increased costs were more than offset by these savings: (1) lower costs for motor-driven blowers alone as compared to the combination of motor-driven forced- and induced-draft fans (2) no expenditure for i-d fan or foundation (3) no need for electrical or combustion-control equipment to the i-d fan (4) no bearing-cooling water or drain piping to the i-d fan (5) much shorter stack could be relocated on top of air heater (6) flue-gas ducts and breechings were much reduced in cost (7) overall size of mats for entire unit ran much less than usual. *ASME paper. No. 50-SA-40.*

ACTUAL TEMPERATURES REACHED BY UNDERFEED STOKER IRON, *by W M Gillespie, Duquesne Power & Light Co.* To better reflect stoker maintenance cost and determine availability factor of steam-generating units fired by underfeed stokers, a study has been made to fix actual temeperature of the castings.

Test unit is a Combustion Engineering-Superheater stoker with twelve retorts, 370 sq ft projected area. Combustion rate runs about 38 lb per sq ft at continuous rating, 41 at peak. Each retort has four secondary rams followed by overfeed ash-discharge section.

The boiler is a 2-drum VUX type with a completely water-cooled furnace, dust collectors, and an air heater. Its output at 175 to 220 psig is 150,000 lb per hr. saturated, at continuous rating, and 165,000 for a 4-hr peak. Heating surface, including waterwalls, goes 14,995 sq ft and furnace volume is 7300 cu ft.

Nine thermocouples were put in; four in the sixth tuyere row, from the front of the furnace spaced down to practically the overfeed section, one in the eighth row. The other four went on two overfeed grate bars; one near center and other on right side of boiler. Two thermocouples were placed on each of these grate bars, one at nose and one at heel.

Tests were run over a two-month period. Preheated air averaged about 250 F. Highest average temperature, about 1100 F, was recorded by a thermocouple at the front of the furnace in the sixth tuyere row. Lowest temperatures, about 500 F, showed up at the heel end of the overfeed grate bars. *NDHA paper. No number.*

Process Heating

PROCESS HEATING BY HIGH-TEMPERATURE LIQUIDS, *by Paul L Geiringer, American Hydrotherm Corp.* There are many heating methods now in existence for process heating in the range of 250

(*Continued on page 214*)

TO OBTAIN COMPLETE TEXT

Material for these abstracts comes from one of the following sources:

American Institute of Electrical Engineers, summer meeting, Pasadena, Calif. June 12-16, 1950. Papers are identified by initials AIEE. Obtainable through AIEE, 29 W 39th St, New York 18, N. Y.

American Society of Mechanical Engineers, semi-annual meeting, St. Louis, Mo. June 19-23, 1950. Papers are identified by initials ASME. Obtainable through ASME, 29 W 39th St, New York 18, N. Y.

National District Heating Assn, 41st annual meeting, Asheville, N. C., May 23-26, 1950. Papers are identified by initials NDHA. Obtainable in printed proceedings through J F Colins, Jr, secy-treas, NDHA, 827 N Euclid Ave, Pittsburgh, Pa.

● **LOAD ON BOILER CUT BY 75 HP** by trapping with Armstrongs, says Chief Engineer of large midwestern hospital.

● **30°-40° TEMPERATURE INCREASE** on 8-roll ironer after unit trapping with Armstrongs, reports large eastern laundry.

● **STARCH DRYER HEAT-UP TIME CUT 2-3 HOURS** after retrapping with Armstrongs, says Canadian plant engineer.

● **125 HP BOILER NOT NEEDED** — 80 HP boiler does the job since Armstrong traps were installed in a chemical plant in Iowa.

● **50% SAVINGS IN TRAP MAINTENANCE LABOR COSTS** since installing Armstrongs at midwest agriculture machinery plant.

● **COOKING KETTLE OUTPUT SPEEDED UP 30%** by Armstrong unit trapping at large canning plant.

. . . BIG EFFECTS from little traps! The "shadow" cast by a steam trap is multiplied in size by the number of traps in your plant until it grows to be a giant that you can't shrug off. Let your nearby Armstrong Representative show you how Armstrong Trapping can cut *your* fuel, production and maintenance costs. Call him today.

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POWER NEWS

BUSINESS ITEMS • APPOINTMENTS • FOREIGN FIELDS
WASHINGTON NOTES • NEW DEVELOPMENTS • CONVENTIONS

How Soon Atomic Power?

By FREDERICK R BREWSTER, *Chief, London Bureau*

LONDON (*McGraw-Hill World News*): By the end of the coming ten years, nuclear power plants will be a technical possibility. But it may be several decades before power from the atom will be able to compete, on a cost basis.

Thus concluded reports presented to the World Power Conference by British and American scientists. The first was agreed to by both Sir John Cockcroft, director of Britain's Atomic Energy Research Establishment, and Ward Davidson, research engineer, Consolidated Edison Co of N. Y. The second conclusion was the result of Davidson's own studies. Significantly, his was the only contribution to the technical session on atomic energy by a private-power expert: the others were all from representatives of state-directed authorities. The other contributors were David A Keys, vice-president, National Research Council, of Canada; L Kowarski, scientific director of France's Commissariat à l'Energie Atomique; and Prof R Liljeblad, ASEA, Sweden. The Canadian, French and Swedish reports, however, were primarily accounts of the work done in those countries.

BRITISH TIMETABLE

The British calculate that building the first experimental power-supplying reactors will probably take the next three to five years. And during the succeeding five years operating experience with them will be gained, leading to design of first full-scale reactors. The same period, at least, will be needed to carry out the chemical-engineering and metallurgical research necessary to make the power project economical in cost.

Davidson's conclusion as to the time before nuclear power will be available at competitive cost—several decades—he qualified by saying:

"This does not mean that considerable nuclear power will not be used; there are certain to be cases where other considerations will outweigh the actual costs. Such cases may be found, for example, where use is made of energy otherwise wasted in the manufacture of bomb materials, or where the power is used for ship propulsion or like service where the saving due to lesser weight of fuel is sufficient to compensate for higher direct costs."

It was this conclusion which was twisted by the Russian delegation into an unwarranted meaning: that atomic power would only be available as a byproduct of military production. The Russians seized on this to make their propaganda point of the week:

"You are well aware," stated Prof Golubtsov, head of the delegation, "that atomic energy in Russia is being used only for peaceful purposes, such as for removing mountains when digging new river beds, for the construction of colossal irrigation schemes, and for turning deserts into blooming areas."

In a vigorous defense of the peaceful bent of atomic-power research, the chairman of the session, Ernest Mercier, of France, pointed out that Davidson's text did not support the Soviet declaration and concluded "No delegate present is ready to regard the peaceful uses of atomic energy as solely a byproduct of military activities."

ATOMIC-POWER PROBLEMS

Analyzing the likely development of nuclear power, Sir John Cockcroft repeated what is already well established: first designs will employ a circulating medium to transfer heat from the reactor to a conventional power-generating system. This involves major problems:

High-Temperature Reactors. The job of achieving reactors operating at temperatures high enough to produce good thermodynamic efficiency will probably be tackled three ways:

1. So called *fast* reactors will be designed to have high efficiency in uranium use by employing the breeding principle. They will generate some of their own fuel by converting U_{238} into plutonium. Such reactors can be fueled with uranium enriched with additional U_{235}, or with plutonium. They have a small volume of fuel elements and thus provide an extremely compact source of heat. But they present formidable heat-transfer problems. Moreover, the materials must withstand a very intense neutron bombardment yet remain stable.

2. In slow-neutron, enriched uranium reactors, neutrons are slowed down by a moderator—graphite, heavy water, or beryllium compounds—until they reach "thermal energies," that is, are in equilibrium with the temperature of the moderator. At these levels, probability of providing fission in U_{235} reaches its highest value. Reactor fuel elements can

(*Continued on page* 212)

COMING EVENTS

Sept 18-22—Instrument Society of America, National Instrument Show, Memorial Auditorium, Buffalo, N.Y. Secretary, Instrument Society, 921 Ridge Ave, Pittsburgh 12, Pa.

Sept 19-21—American Society of Mechanical Engineers, fall meeting. Hotel Sheraton. Worcester. Mass. O B Schier, secy. ASME, 29 W 39th St. New York 18, N. Y.

Sept 26-29—Association of Iron & Steel Engineers, Cleveland, Ohio. T J Ess, managing director, 1010 Empire Bldg. Pittsburgh 22, Pa.

Oct 2-5—Technical Assn of Pulp and Paper Industries, engineering meeting, Netherland Plaza, Cincinnati, Ohio. R T Bingham, TAPPI, 122 E 42nd St, New York, N. Y.

Oct 15-18—American Public Works Association, public works congress and equipment show, Hotel New Yorker, N. Y. F H Zurmuhler, general chairman, Bureau of Public Works, City Hall, New York, N. Y.

Oct 19-21—Institute of Power Engineers of Canada, 1950 Convention, Windsor Hotel, Montreal 1, P. Q. General Secy, Institute of Power Engineers, 496 Church St, Toronto 5, Ontario.

Oct 23-27—American Institute of Electrical Engineers, fall meeting, Skervin Hotel, Oklahoma City, Okla. H H Henline, secy, AIEE, 29 W 39th St, New York 18, N. Y.

Nov 27-Dec. 2—American Society of Mechanical Engineers, 19th National Exposition of Power and Mechanical Engineering, Grand Central Palace, New York, N. Y. Charles F Roth, mgr, International Exposition Co, Grand Central Palace, New York, N. Y.

From routine water treatment reports and water sample analyses, experts at Nalco Laboratories keep a complete record of your plant water treatment — can assist materially in maintaining permanent water treatment security.

How a *Nalco* WATER TREATMENT SERVICE AGREEMENT WORKS FOR YOU

OPERATION of your plant under a Nalco Water Treatment Service Agreement gives you two important safeguards against water treating problems in any form. First, Nalco will provide proper water treatment chemicals and procedures. Second, an experienced Nalco Service Representative will make regular visits to your plant, and is on call at any time to deal promptly with emergencies. Whether you have 10 or 10,000 BHP, this combination will provide what thousands of Nalco System users have learned to take for granted: *permanent water treatment security.*

Write, now, for full information on a Nalco Service Agreement for your plant.

Nalco

SERVICE AGREEMENT SECURITY FEATURES

- **COMPLETE WATER TREATMENT SURVEY** of your plant by an experienced Nalco representative.
- **LABORATORY ANALYSES** of water samples . . . Initial complete analyses, followed by routine sampling and analyses as checks on plant tests.
- **RECOMMENDATIONS** of chemicals, testing and control procedures to establish water treatment security.
- **REGULAR CALLS** by a Nalco Representative to assure continuously successful treatment.
- **REPORT SYSTEM** to Nalco Laboratories gives cross-check on all phases of the Nalco System; enables keeping of complete performance records on your plant.
- **CONSULTING SERVICE** always available to assist in solving current problems — and in planning changes or additions to your plant which may affect water treatment.

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6222 West 66th Place • Chicago 38, Illinois

Canadian inquiries should be addressed to Alchem Limited, Burlington, Ontario, Canada

THE *Nalco* SYSTEM • Serving Industry through Practical Applied Science

JENKINS PRACTICAL PIPING LAYOUTS

54

How to plan

STEAM DESUPERHEATER PIPING CONNECTIONS

Desuperheaters are used extensively in power and industrial plants where steam is generated at high pressure, with or without superheat, but where steam is required at lower than boiler pressure without superheat. Existing generating plants are continually adding more capacity with higher pressure boilers and turbines. In these plants it is usual to discontinue the low pressure boilers and obtain low pressure steam by use of pressure-reducing valves. This low pressure steam is highly superheated as a result of low throttling from higher pressures and the superheat must be removed before it can be used in the low pressure equipment. In addition, larger heat exchangers are required if superheated steam is used, and often it is more economical to desuperheat the steam to permit the use of smaller equipment for heat exchange.

The system shown here employs pressure reducing valves and a desuperheater. Where the range of operation is very large, more efficient operation is obtained by installing 2 pressure-reducing valves of different capacity, with the smaller valve operating at low flows of steam.

The pressure-reducing valves are usually controlled by a pneumatic control system in which the pressure-reducing valve is positioned according to the downstream pressure being controlled. The pressure-reducing valves in turn operate the water regulator valves which allow water at high pressure from the boiler feed pumps to flow to the desuperheater nozzle. In addition, an automatic regulator which controls the exact amount of water flow based on the downstream temperature is used. The water is introduced, in a fine spray, in the throat of a venturi nozzle where steam and water is intimately mixed and a uniform steam temperature is produced.

The Jenkins Valve numbers listed are based on superheated steam pressures from 400 to 600 psi. and low pressure steam from 125 psi. down.

For the distribution of the high pressure steam Jenkins Fig. 1012 Cast Steel, Outside Screw and Yoke, Gate Valves with either flanged or weld ends are recommended. Ruggedly designed to withstand pressure strains and rapidly vibrating steam currents, these valves, when fully open, permit an unobstructed flow. Screwed in seats are replaceable and valve can be repacked under pressure. Sizes 8" and smaller have a solid wedge "I" beam construction — larger sizes have separate seat faces. Bonnet has condensing chamber and plugged connection. Flanged bodies, 2" and up, have seven blind bosses to attach drain connections and by-passes.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installations.

A CHOICE OF OVER 500 VALVES

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering experience, select all the valves you need from Jenkins Catalog. *It's your best assurance of lowest cost in the long run.* Despite their extra value, *you pay no more* for Jenkins Valves. Jenkins Bros., 100 Park Ave., New York 17; Jenkins Bros., Ltd., Montreal. Sold through leading Industrial Distributors everywhere.

Reserve your copy of
NEW BOOK OF PIPING LAYOUTS — NOS. 26 to 50

A new book of Jenkins Practical Piping Layouts — Nos. 26 to 50 — is in preparation. Mail coupon to get your copy when ready.

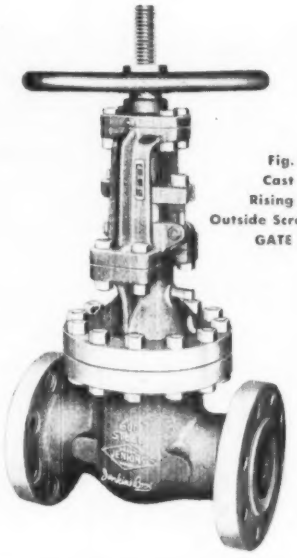

Fig. 1012
Cast Steel,
Rising Spindle
Outside Screw and Yoke
GATE VALVE

JENKINS BROS., 100 Park Avenue, New York 17, N. Y.
Reserve book of Piping Layouts—26 to 50—for:

Name _____

Company _____

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STEAM DESUPERHEATER PIPING CONNECTIONS

Code	Quan.	Jenkins Valves	Service
A	5	Fig. 1012 Cast Steel Gate	High Pressure Superheated Steam Distribution
B	4	Fig. 1012 Cast Steel Gate	Pressure Reducing Valve Shutoff
G	1	Fig. 1009 Cast Steel Gate	Low Pressure Desuperheated Steam Shutoff
K	1	Fig. 106-A Bronze Globe	Condensate Free Blow
L	1	Fig. 670 Bronze Gate	Condensate to Trap Shutoff
M	1	Fig. 106-A Bronze Globe	Trap Test
N	1	Fig. 92 Bronze Check	Prevent Condensate Backflow
P	1	Fig. 670 Bronze Gate	Condensate Shutoff
R	2	Fig. 106-A Bronze Globe	Compressed Air Supply to Pneumatic Controllers
T	2	Fig. 106-A Bronze Globe	Compressed Air Line Drains
U	3	Fig. 106-A Bronze Globe	Pressure Control Line Drains
X	1	Fig. 741-G Bronze Needle	Pressure Gauge Control
Y	3	Fig. 741-G Bronze Needle	Compressed Air Pressure Gauge Control

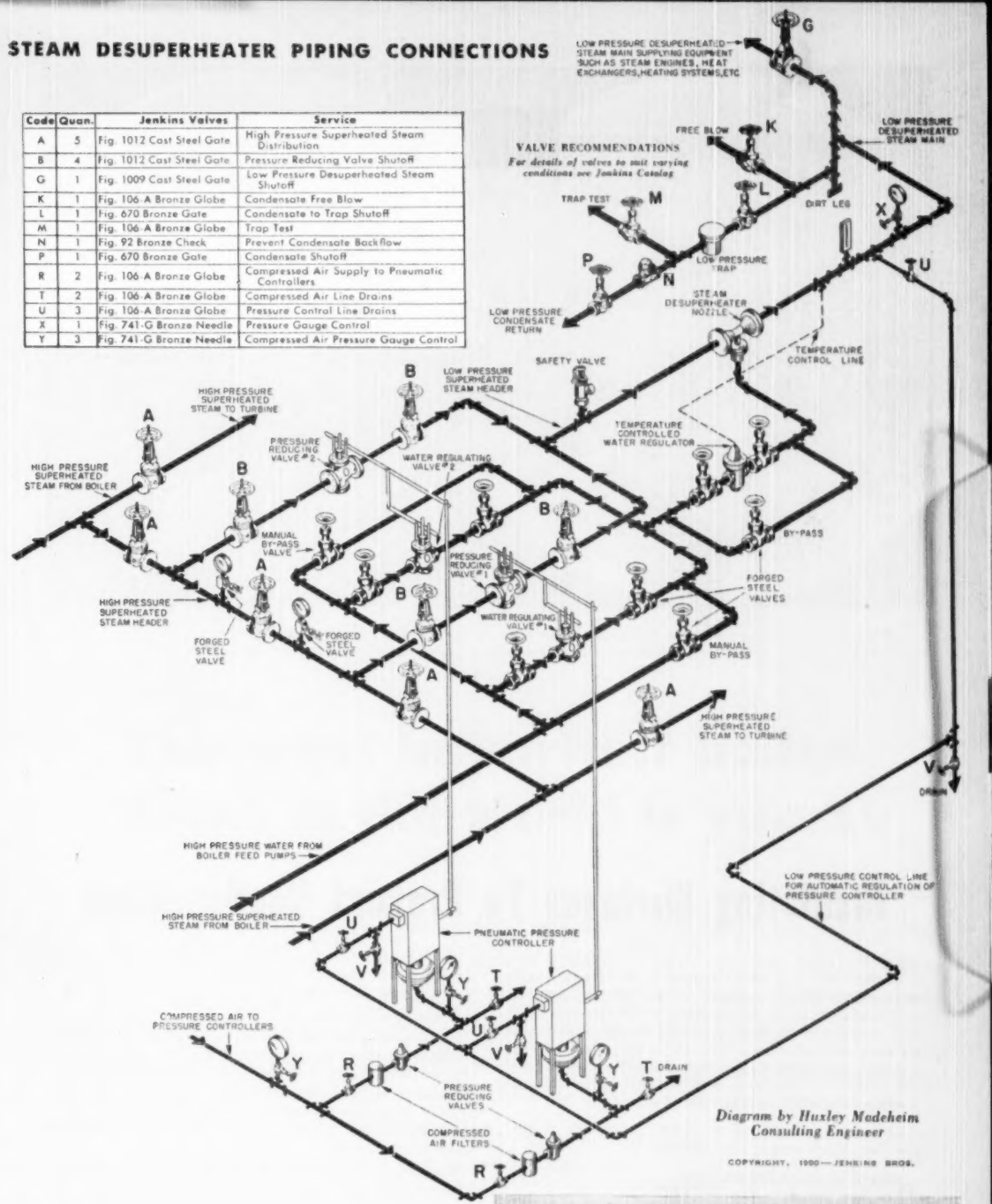

Diagram by Huxley Madeheim Consulting Engineer

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illustrating the proved 3-point formula for trouble-free, time-defying hookups

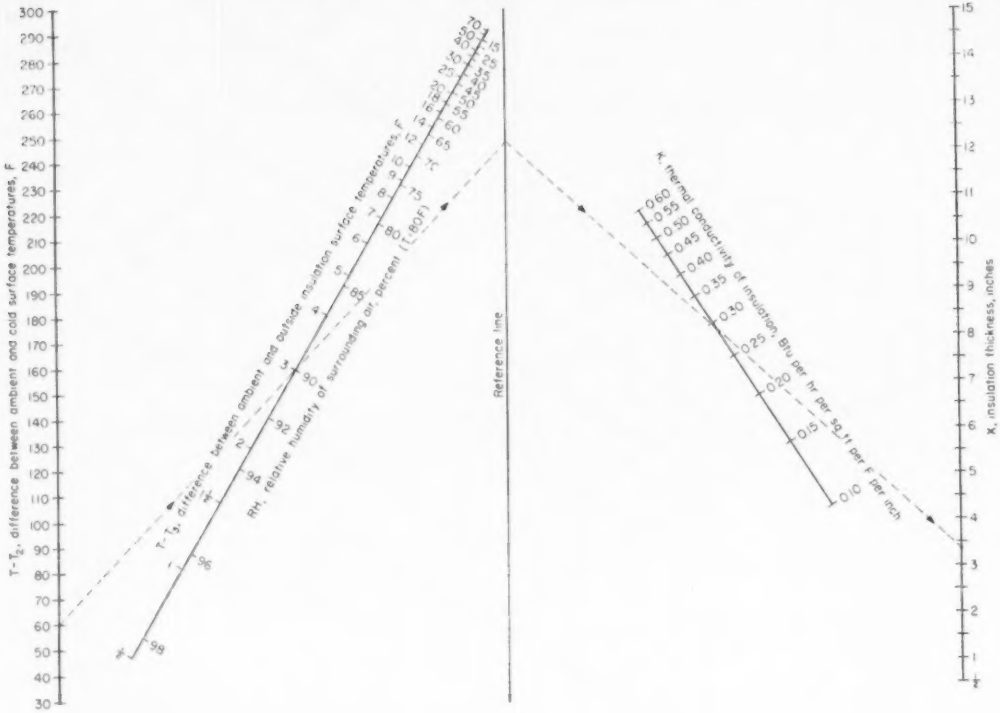
- A **Use the right type valve for the service**
- B **Place valves correctly in the line**
- C **Choose Jenkins for lifetime economy**

JENKINS VALVES

LOOK FOR THE DIAMOND MARK

SINCE 1864 — TRADE JENKINS MARK

Number 219


T-T₂, difference between ambient and cold surface temperatures, F
T-T₂, difference between ambient and outside insulation surface temperatures, F
RH, relative humidity of surrounding air, percent (T_dbF)
Reference line
K, thermal conductivity of insulation, Btu per hr per sq ft per F per inch
x, insulation thickness, inches

Insulating Surfaces To Prevent Condensation

Surfaces kept at a lower temperature than the surrounding atmosphere condense moisture. To prevent "sweating," surface should be lagged. By providing enough thickness, insulation surface can be kept above the temperature at which moisture will condense out of the air for prevailing humidities.

Above nomogram enables finding thickness needed for a wide variety of insulating materials and temperature and humidity conditions. It is based on the formula:

$$\frac{T-T_2}{\frac{x}{k}+\frac{1}{f}} = f(T-T_1)$$

where

T = dry-bulb temperature of surrounding air, F

T_1 = temperature of original cold surface, F

T_2 = surface temperature of insulation, F

f = coefficient of heat transfer of air film next to insulation = 1.65 Btu per hr per sq ft per F

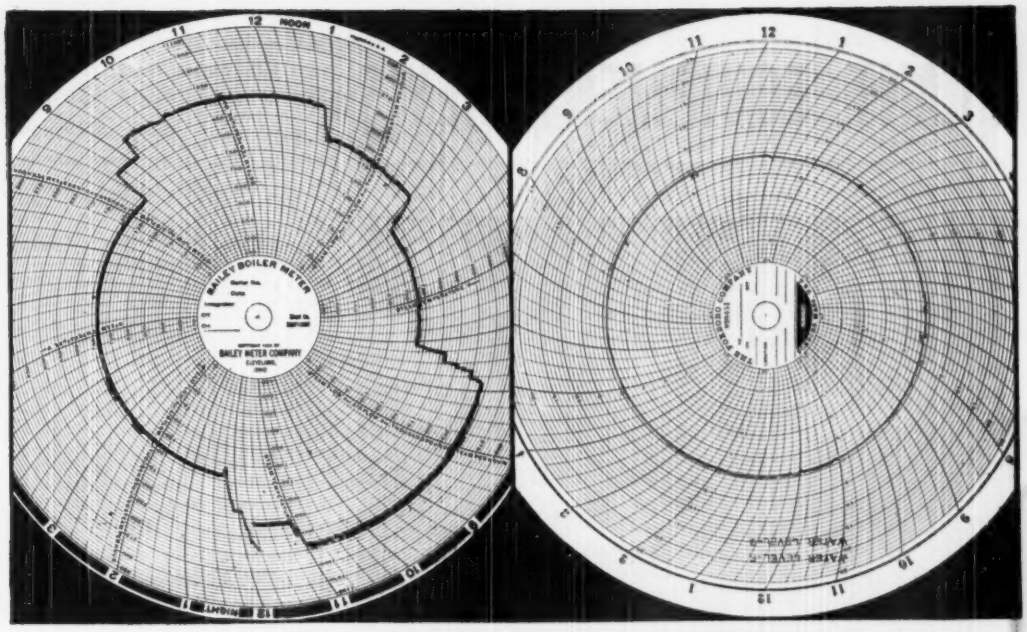
k = thermal conductivity of insulation, Btu per hr per sq ft per F per in. thickness

x = insulation thickness, in.

The relationship between relative humidity and $T-T_2$ shown on the first inclined scale is based on 80-F dry-bulb temperature and can be readily found on any psychrometric chart.

Example: Find insulation thickness needed to lag a surface at 34 F to prevent condensation in an atmosphere of 94 F and 90% relative humidity. The K factor for insulating material equals 0.29.

First find $T-T_2 = 94-34 = 60$ F. Then lay a straight edge from 60 F on first scale to intersect 90% humidity on inclined scale, thus finding intersection with reference line. From reference line lay a straight edge to intersect inclined scale at 0.29 and find intersection, 3.4 in., on right-hand thickness scale. Nearest practical thickness would be 3.5 in. *Courtesy Industrial Mineral Wool Institute, New York, N.Y.*



Left: Steam flow from B & W Type FH Boiler rated at 275,000 pounds per hour, 900 psi, 910 F. Right: Drum level held within ± ½ inch by COPES Flowmatic

The most important boiler plant in the world is yours

You hear a lot about one plant or another being important. But no other plant in the world is as important to you as the one for which you are responsible. All any other plant means to you is a chance to learn how to better your own.

Take the boiler from which the charts above were obtained. That it is one of the largest Babcock & Wilcox Integral Furnace Boilers ever built concerns you only because operating experience with it can help you with your own operation.

Study the charts carefully. How do your loads compare? Do you have such sudden sharp changes in rating? Is your drum level held as closely despite the changes? It can be —if your boilers, like this one, are equipped with COPES Flowmatic feed water control. And simple routine care by plant personnel takes care of all maintenance.

Write for Performance Report 487 on this public utility plant. It might help you better the world's most important plant—your own.

NORTHERN EQUIPMENT CO.
901 Grove Drive, Erie, Pa.

BRANCH PLANTS: Canada, England, France, Austria, Italy. *Representatives Everywhere*

COPES

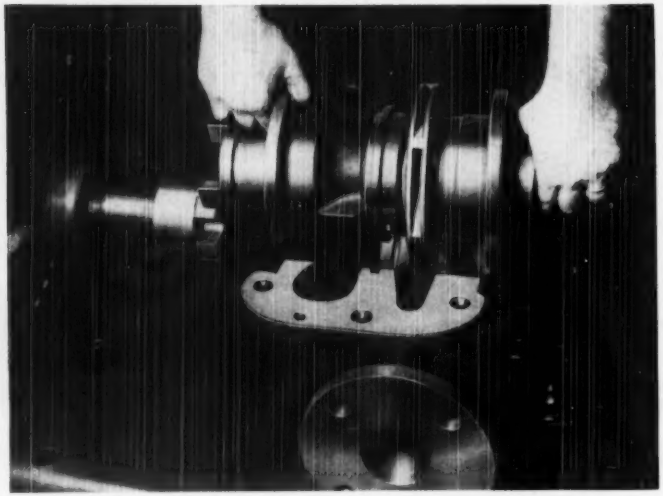
Headquarters for . . .

Boiler Feed Water Control . . . Excess or Constant Pressure Control, Steam or Water . . . Liquid Level Control . . . Balanced Valves . . . Desuperheaters . . . Boiler Steam Temperature Control . . . Hi-Low Water Alarms.

PLANT EQUIPMENT NEWS

Published monthly as a service to readers

Your information center for new products to solve plant problems. Spot what you need, use handy cards p 190a, to get more details



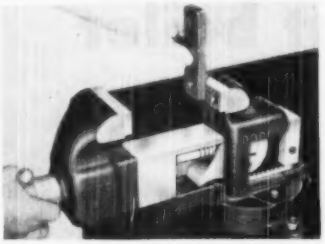
PUMP WITH SERVICE EXCHANGE PLAN P911

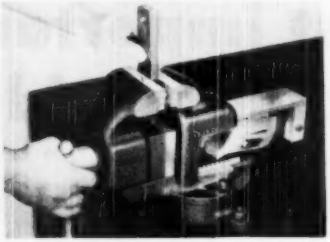
Small standardized general-service pumps to fit a service and exchange plan. All parts except the pump casing are contained in rotor assembly. When maintenance is required you simply remove top cover and endplate studs, lift out rotor assembly and drop in a new one.

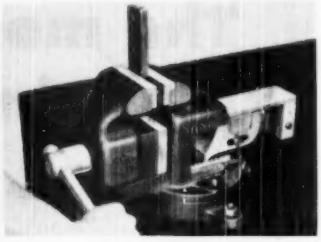
Through the service and exchange plan new rotors are available for immediate shipment from factory stock. Old assembly is returned to factory and full credit is given for all serviceable parts. As an alternate to this a customer can exchange the entire pump for a factory rebuilt and guaranteed unit, with credit allowed for serviceable parts.

Pumps are built in three sizes for capacities to 450 gpm and heads to 230 ft. Stainless-steel impeller shaft eliminates shaft-sleeves, and reduced shaft length between bearings gives a stiffer shaft to care for hydraulic disturbances.

De Laval Steam Turbine Co, Trenton 2, N. J.



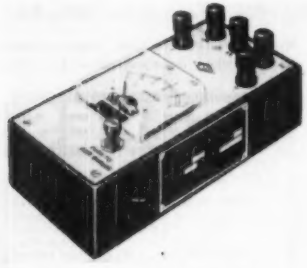




THIS FAST MOVING MACHINIST VISE USES PUSH-PULL ACTION P963

This 4-in. vise opens or closes to any position in one second through a push-pull action that eliminates spinning the handle. Turning handle counter-clockwise throws vise into neutral position ready for fast slide action in either direction. A push will close jaws on work . . . or a pull will open them. Then as jaws contact work, a clockwise turn of the handle applies full pressure. Tool weighs 58 lbs and combines power of conventional vise with new fast slide action. Vise shown above is for demonstration only.

Dodge Mfg Co, Mishawaka, Ind.



CURRENT TRANSFORMER FIELD-TEST SET P900

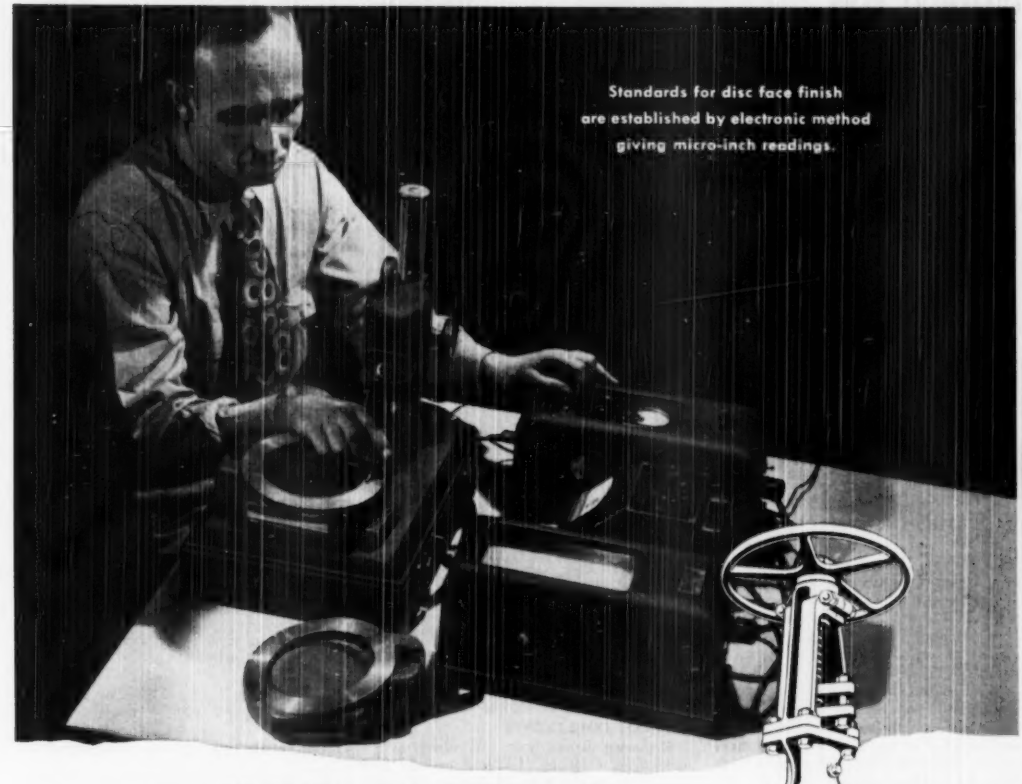
Device quickly checks ct's for short-circuited turns, high-resistance joints or grounds. Instrument has four current ranges: 1.25, 22.5, 5 and 10 amp. Test can be made without interrupting customer service and while the load is on.

Operating principle hinges on fact that when a ct is free of internal defects there will be no great change in ratio with substitution of a burden of about 100 va. In other words, current as indicated on ammeter should decrease only a few percent when instrument switch is pressed and burden added. In a good transformer, main effect of added burden should be only a rise in primary and secondary voltage.

But when one or more turns within transformer are shorted then an appreciable part of total available ampere-turns are diverted into the short. Then current to watthour meter is less than total secondary current of transformer. Now if burden of test set is added in series with watthour meter, high impedance of meter circuit will divert still more current into shunt path provided by shorted turns. Hence meter

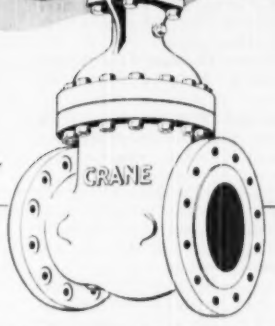
For further data on above items use reply cards on page 190a, identifying your request with letter P and number

More **CRANE VALVES** are used than any other make



How CRANE controls quality to the Micro-Inch to cut your valve costs

Surface finish of a valve's working parts has a lot to do with its wear resistance and operating efficiency. A correct finish means a tighter-seating valve, easier operation, greater ease of maintenance. In Crane Quality valves, the surface finish of machined parts is measured and controlled to rigid limits. The standards for quality control of surface finish are determined by the most scientific methods as shown above. Yes, nothing is overlooked to make Crane Valves the lowest-cost valves in the long run. *That's Crane Quality!*



Precise quality control of materials, design, and manufacturing—to the highest degree in the industry—makes Crane valves the lowest cost valves in the long run. On steam service, oil and oil vapor lines, for example, you'll find Crane Steel Gate Valves a sure remedy for high maintenance costs. Talk it over with your Crane Representative.

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

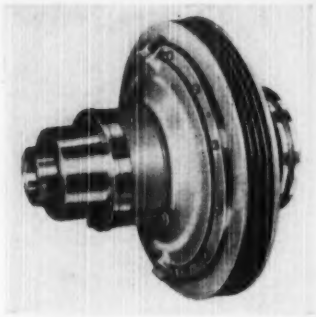
VALVES • FITTINGS • PIPE • PLUMBING • HEATING

EQUIPMENT NEWS—CONTINUED

current will decrease by a large amount. This will show up on ammeter.

Instrument dimensions are 7¼ x 3⅞ x 3⅛-in. Device weighs 2 lb and is housed in non-conducting molded plastic case.

The Eastern Specialty Co, 361-8 N. 8th St, Philadelphia 40, Pa.



MAGNETIC-PARTICLE CLUTCH P901

Clutch uses linking action of dry magnetic mixture in a magnetic field. Magnetic mixture is made of iron particles and flaked graphite. Electric current flowing through a coil supplies magnetic field. Controlling current through coil regulates clutching action.

Clutch is suitable for small power transmission with fast response and no wear on the torque-transmitting surfaces. Clutch develops torque at zero slip, has large maximum to minimum torque ratio and is easily adapted for remote control.

Vickers Electric Division, Vickers, Inc, 1815 Locust St, St Louis, Mo.

SUBMERSIBLE PUMPS P902

Pump and motor are assembled as a unit designed to operate submersed in a well. Installed by lowering pump on its discharge pipe to proper depth in well and connecting a submarine cable to power source. Multistage pump is constructed of bronze and stainless steel. Motor is built for underwater operation.

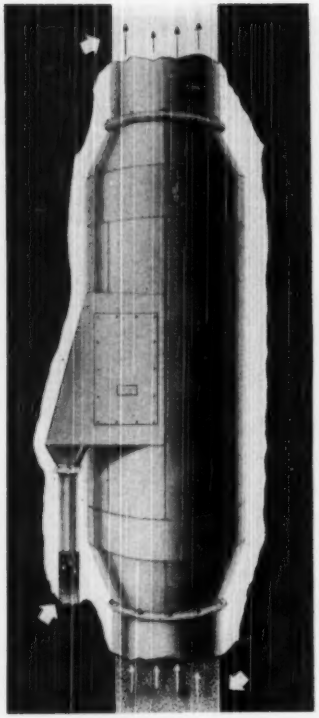
Pumps are designed for domestic and industrial water systems in sizes from 0.7 to 60 hp and 5 to 1250 gpm for a maximum head of 500 ft and 6-in. minimum well diameter. Bulletin No. 100 sent on request.

Sumo Pumps, Inc, One Atlantic St, Stamford, Conn.

MASONRY-SAW PUMP P903

This pump does away with extra belt and pulley formerly used. It can run dry without harm. Pump self primes and its aluminum construction resists corrosion. It does not have seals or rubbing surfaces to wear under the abrasive action of the coolant, inherent in wet-cutting masonry saws using a self-contained water system.

Champion Mfg Co, 2028 Washington Ave, St Louis 3, Mo.



FLYASH COLLECTOR P913

Removing flyash, soot and cinder particles from a column of moving gas can be done with fairly high efficiencies if that column can be put through a high velocity, whirling action. Most times that velocity is developed by increasing fan size to handle the extra load. This flyash collector operates without benefit of an electric motor as a power source.

Here's a mechanical dust collector, called the *Regenerative*, that is said to develop the needed centrifugal force for particle separation without using a fan. In addition to the advantage of no power cost the device is reputed to maintain collection efficiency independently of varying load conditions such as occur during soot-blowing, fire-cleaning and lancing operations. What's more it has no moving parts, further reducing the maintenance problem.

Here's how the *Regenerative* flyash collector works. Gas entering the collector passes through an aerodynamic accelerating zone. This zone consists of specially designed passages that transform gas pressure to velocity.

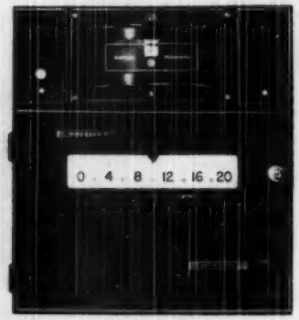
At this high velocity the gas goes into a whirling zone. The solid particles are thrown out and leave by chutes for disposal. Finally the cleaned gas goes into a decelerating zone where the gas velocity is reconverted to gas pressure.

Joseph Breslove, Jr, Oliver Bldg, Pittsburgh 22, Pa.

WELDING CABLE P946

Neoprene-covered welding cable, *Lin-Conductor*, has a 2.5-mil paper thickness between outer cover and copper stranding. These features are said to increase cable life and flexibility. Available in 4/0, 3/0, 2/0, 0, Nos. 1, 2, 4 and 6 wire sizes.

Lincoln Electric Co, 12818 Coit Rd., Cleveland 1, Ohio.



POTENTIOMETER CONTROL P968

Temperature, speed, flow, pressure, ac or dc voltage, amperes, etc. can be controlled with accuracy with the *Potentiotrol*. Measurements may be obtained with any primary element producing an electric impulse such as thermocouples, radiation detectors, resistance bulbs, etc.

Wheelco Instrument Co, 843 W. Harrison St. Chicago 7, Ill.

SANDER POLISHER P948

Speedy, easily-handled versatile Model 2000 electric sander, weighing 5 lbs, delivers 14,400 strokes per minute of 3/16 in. length. It operates from 110-120 v, 60 cycle, ac and carries a pressure-type hand switch in its bakelite cover.

Dremel Mfg Co., Racine, Wis.

CORROSION CONTROL P943

Plastic slide comparator, 10 in. long, 2¼ in. wide, 4 in. high, weighing 1½ lb, permits rapid check of pH and chromate content of cooling waters, brines. Comparator consists of a slide and a base. Slide has five pH standards and four chromate. Base contains 2 vials of pH indicator solution.

W A Taylor & Co, 7300 York Rd, Baltimore 4, Md.

FORK TRUCK P944

Low cost, lightweight *Spacemaster JFTT* lift trucks come in standard capacities of 1000, 1500, 2000 lbs for loads 32, 40 and 48 in. long. Lifting heights on telescopic models are 130, 106 and 82 in. with corresponding collapsed heights of 83, 71 and 59 in.

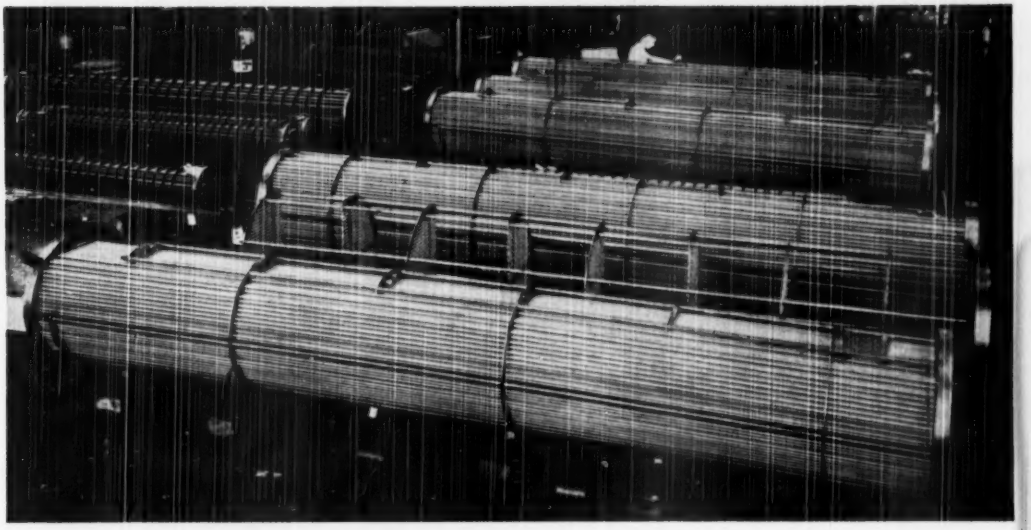
Lewis-Shephard Prod Inc, 261 Walnut St, Watertown 72, Mass.

THERMOCOUPLES P945

Speed response nine times that of former models is manufacturer's claim for new line

For further data on above items use reply cards on page 190a, identifying your request with letter P and number

For Condenser Tubes... Consult Revere!



● Because each condenser installation presents an individual combination of conditions, let no one tell you that any one alloy is best. Every factor should be studied before deciding on the proper alloy. In some cases, Revere Admiralty tubes may be the most desirable. In others, aluminum brass might be preferred. Where brackish or salt water is encountered, cupro-nickel tubes usually are advisable. It all depends on the economic factors and conditions of service.

To find the alloy or combination of alloys best suited to meet the specific operating conditions of *your* condensers, Revere offers the help of its Research Department, made available through the Technical Advisory Service. Working with the engineers of the country's leading users of condensers and heat exchangers, these capable consultants have helped solve many and varied types of problems. This knowledge and experience, acquired over the years, is at your command, ready to help you obtain long service and maximum economy.

Revere makes tubes and tube sheets in all the customary alloys. Before specifying tubes for new condensers, or replacing tubes in old ones, consult Revere.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

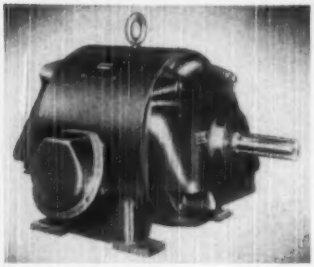
• • •

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.—Sales Offices in Principal Cities, Distributors Everywhere.

EQUIPMENT NEWS *CONTINUED*

of butt-welded thermocouples. Mass of junction has been reduced in the 8-, 14-, and 20-gage types. Thermocouple wire is shaped to form a loop close to hot junction and its small dimensions now permit fitting loop tightly inside a well.

Brown Instr Div, Minneapolis-Honeywell Regulator Co, Wayne & Roberts Ave, Phila 44, Pa.

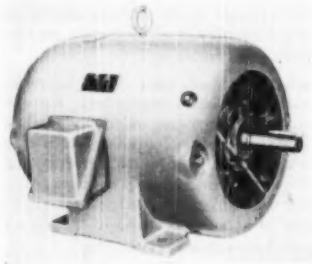


SPLASH-PROOF MOTOR **P999**

Squirrel-cage *Life-Line* induction motor fully protected from dripping or splashing liquids by solid rolled-steel frame and baffles in end brackets. Motors are equipped with prelubricated bearings. No lubrication is required for life of bearing.

Typical applications of these motors include food-processing plants, chemical plants, boiler rooms, laundries, refineries and similar places where splashing liquids are frequently met. Motor is available in ratings of 7½ to 100 hp and voltages up to 2300.

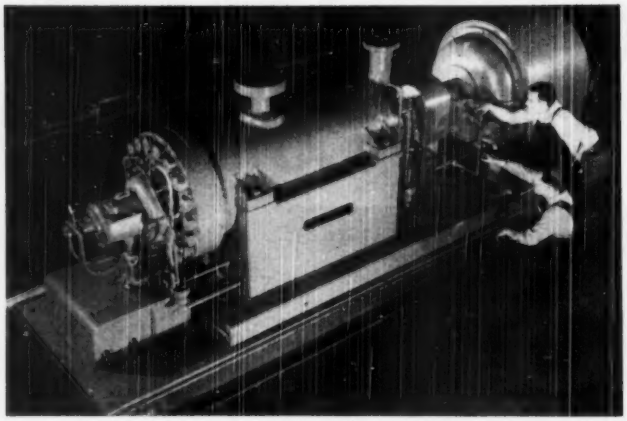
Westinghouse Electric Corp, P O Box 2099, Pittsburgh 30, Pa.



TEFC MOTORS **P969**

Totally enclosed fan-cooled motors available in ratings from 5 through 250 hp in both standard and explosion-proof designs. Cast-iron motor frames are especially suitable for applications in chemical plants, oil fields, petroleum refineries, etc. They fit well into the picture when corrosion is a problem either because of nature of materials to be processed or because motors must be installed outdoors.

Wagner Electric Corp, 6400 Plymouth Ave, St. Louis 14, Mo.



PUMP: 1200 TO 2500 PSI **P912**

A single-suction double-case, barrel-type boiler-feed pump. It has back-to-back impellers and radially balanced volutes in a split inner casing. In the larger capacity pumps, first stage has two single-suction impellers in parallel. Each takes one half flow giving advantages of a double-suction impeller. This permits operation at lower suction heads. Design gives radial and axial hydraulic balance and freedom for expansion in any direction as well as accessibility for maintenance. While the pump is intended primarily for boiler-feed service it can be used on other high-pressure applications.

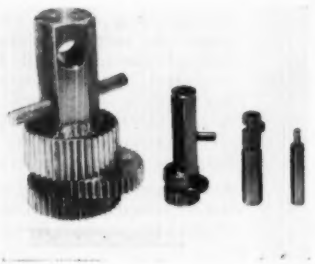
Allis-Chalmers Mfg Co, Milwaukee 1, Wis.

AIR-FLOW MEASUREMENT **P981**

Air Ventimeter measures ventilation air flow with a miniature nondirectional probe. Velocities between 5 and 6000 fpm can be measured. Indicator and probe operate on noble-metal thermopile principle.

Unit is suitable for microclimatology studies, controlled ventilation during painting, finishing and drying processes, cooling and air studies in motor and machinery design, air-flow measurements within small ducts and grilles and similar applications.

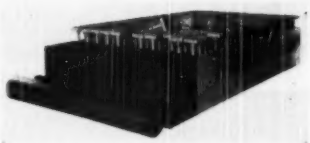
Hastings Instruments Co, Inc, Hampton, Virginia



PIPE WRENCHES **P934**

Heat-treated alloy steel makes rugged internal pipe wrenches for use with standard, extra heavy and double-heavy piping of all standard sizes from ⅛ to 4 in. They are of particular value in removing worn or broken fittings.

Roddick Tool Co, 112 Rochester St, Costa Mesa, Cal.



GAS BURNER **P940**

Low-draft, single-assembly gas burner fires all sizes of furnaces and boilers in the commercial-industrial field from 450,000 to 11,520,000 Btu input. Burner, known as *GCV* series, includes manifold, piping, draft box and draft doors. Burner heads are inserted in sockets that show in above photo.

Iron Fireman Mfg Co, 1305 SW 12th Avenue, Portland 1, Oregon.

SOCKET SCREWS **P930**

Smaller size socket set screws and cap screws have been added to the manufacturer's line of multi-spline socket-screw products. The new socket screws are made as small as No. 2 wire, cap screws in diameters to No. 0 wire size.

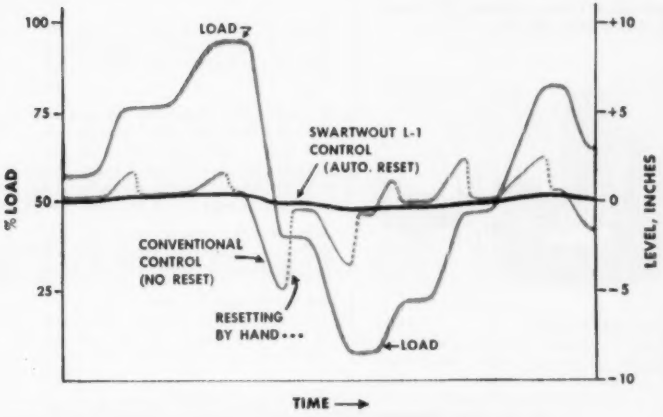
Bristol Co, Waterbury 20, Conn.

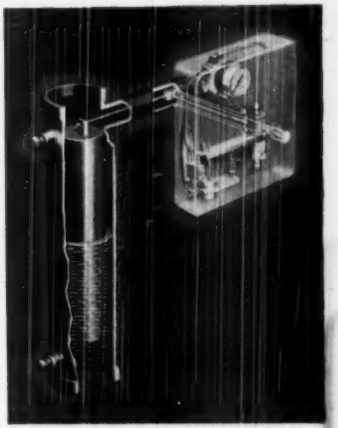
WATER SOFTENER **P918**

Sludge contact reactor, the *Cochrane-Liquon*, employs the principle that previously formed precipitate added as a sludge or slurry will accelerate chemical reactions. It is designed for such services as clarification of surface water, lime or lime-soda softening, clarification and/or softening of

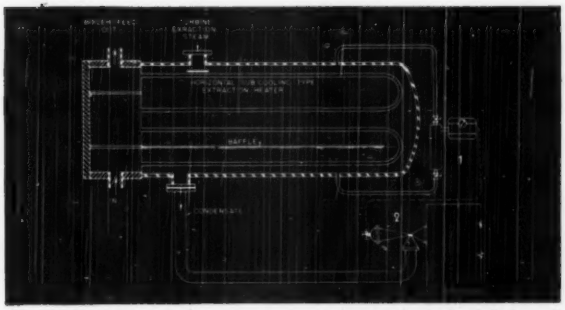
For further data on above items use reply cards on page 190a, identifying your request with letter P and number

Swartwout L-1 Control maintains condensate level within ±½ inch in horizontal subcooled heaters without manual readjustment!





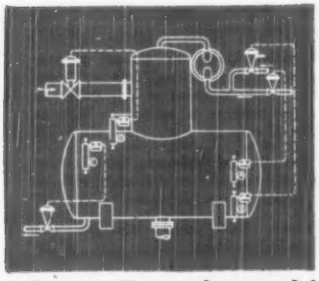
1 Operating on balance of forces principle, Swartwout L-1 Liquid Level Control has little actual movement of parts. Changes in liquid level vary effective weight of buoyant float . . . permit *complete control or throttling over full float length* of from 15 to 120 inches. Reset and setback features automatically compensate for any load condition.



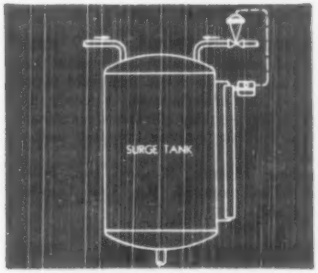
2 Horizontal subcooled heat exchanger *(above)* reduces degradation of heat in extraction steam by cooling condensate below saturation temperature. L-1 Control (1) holds level to ±½ inch for maximum heat extraction at any load. Swartwout V-10 regulating valve (2), with exclusive scroll inlet, withstands punishment of high-velocity flashing condensate.

Swartwout

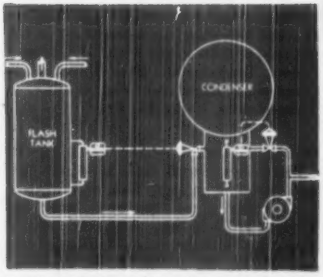
POWER PLANT EQUIPMENT



3 Deaerating Heaters. – Swartwout L-1 Controls are used for normal (A), emergency (B & D), and overflow (C) control. Also used in stage heaters for normal, emergency and by-pass control.



4 Surge Tanks.—Swartwout L-1 Control gives extended range over virtually entire height of tank for maximum "flywheel effect." L-1 Controls are also ideal for storage tanks.



5 Flash Tanks and Condenser Hot Wells. —Flash tank drains to hot well where Swartwout L-1 Control precisely maintains required level by controlling condensate recirculating pump discharge.

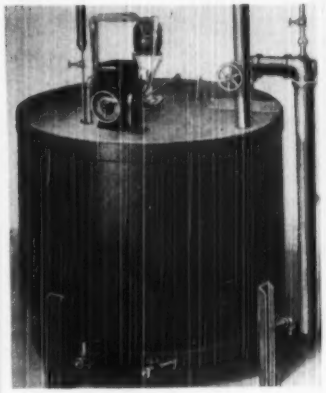
A-2790

SEND FOR BULLETINS S-15-A, S-208A • THE SWARTWOUT COMPANY, 18511 EUCLID AVENUE, CLEVELAND 12, OHIO

EQUIPMENT NEWS *CONTINUED*

makeup water from surface or well waters, coagulation and reduction of alkalinity as pretreatment ahead of ion-exchange or hot-process softeners, removal of silica and fluorides.

Cochrane Corp, 17th St and Allegheny Ave, Philadelphia 32, Pa.



CHEMICAL FEED **P941**

Rugged, flexible chemical-feed control, the *Electro-Chemical*, takes water through an integrating raw-water meter. When a predetermined amount passes, control unit and a time switch go into action. Since chemical solution is proportional to flow of water, manually adjusting a knob on time-switch dial varies rate of chemical feed as desired.

Permutit Co., 330 W. 42nd St, New York 18, N. Y.

LIQUID LEVEL **P942**

Pneumatic, liquid-level transmitter using buoyant force of a partly immersed cylinder requires neither purges nor liquid seals. Its sensitivity is one part in 14,000 and has a reproducibility within plus or minus 1% of full scale. Differences in level from 14 to 120 in. for liquids of various specific gravities and viscosities, at pressures up to 600 psi, temperatures to 450 F can be handled.

Brown Instruments Div, Minneapolis Honeywell Regulator Co, Wayne & Roberts Ave, Phila 44, Pa.

CABLE HOIST **P949**

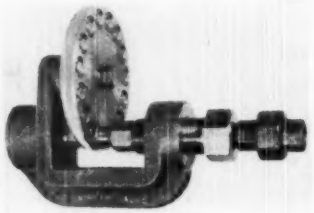
Heavy-duty, electric cable hoists, the *Bob-Cats*, range in capacity from ½ to 5 tons. Load-sustaining parts are made from steel forgings and castings. A double internal gear train incorporates two Weston-type load brakes.

Ohio Electric Mfg Co, 5900 Maurice Ave, Cleveland 4, Ohio.

GAS BURNER SAFEGUARD **P950**

Electronic flame-failure protection and semi-automatic ignition control can be had for commercial and industrial gas-burning with the Fireye System *FF-6*. It includes a flame rod, Type 45 JQ1, and a control. Flame rod mounts near gas pilot on burner plate and projects into flame. When flame fails, rod signals control and fuel is cut off.

Combustion Control Corp, 77 Broadway, Cambridge 42, Mass.

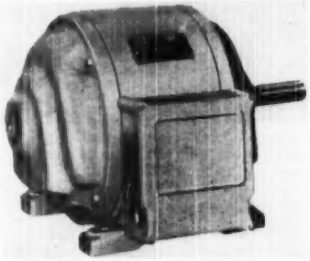


BLOWOFF VALVE **P975**

Boiler continuous blowoff valve has 15 calibrated orifices on indexed wheel. Each orifice is numbered to correspond to a flow chart provided with unit. Blowoff is measured directly in lb per hr. Valve eliminates intermittent manual blowoff.

Sediment separation chamber ahead of valve prevents plugging by scale. Velocity reducing chamber is fitted to valve discharge. Water samples are taken from cock on velocity-reducing chamber.

The Uniblow Valve Co, 1916 West 77 Street, Cleveland 2, Ohio



CAPACITOR MOTORS **P988**

Single-phase capacitor-type motor has been added to the *Klosd* drip-proof motor line of this manufacturer. A newly designed starting relay eliminates centrifugal switches or any rotating throw-out mechanisms.

Sterling Electric Motors, Inc, 5401 Anaheim-Telegraph Rd, Los Angeles 22, Calif.

METER STUFFING BOX **P952**

Leakproof, high-pressure orifice-meter stuffing box reduces meter maintenance, requires no lubricant. Heart of stuffing box is a combination packing and bearing machined from plastic, *Teflon*. A spring-loaded follower sleeve compresses bearing

(*Continued on page* 164)

Thumb Back a Few Pages And Check These, Too ...

Welding Shield fitted with periscope for getting into offset or close places. Device has conventional fiber facing ..... p 164

Magnetic Level has built-in magnets so it will attach to iron surfaces. Clock-face gage determines any angle to 360 deg ..... p 164

Temperature Regulator operates on the vapor flash principle. Liquid in control bulb expands with increase in ambient temperature. It is then forced into a steam-jacketed power bellows where it flashes to vapor ..... p 166

Light-Weight Diesel rated 275 hp. Unit fitted for earth-moving and general industrial jobs ..... p 168

Overflow Check Valve designed to prevent loss of liquid from manometer or indicating gages. Can be made integral with some gages and manometers ..... p 168

Flow-Control Valve suitable for regulating steam, water, oil and gas flow. Valve is air or water operated ..... p 170

Fire Detector consisting of 6 detectors and one control panel covering an area up to 120 by 80 ft. Detectors utilize photoelectric tubes ..... p 172

Packaged Boiler in two sizes covering a range of 1½ to 3¾ million Btu output. Unit burns No. 3 oil or lighter and natural gas ..... p 172

Repulsion-Induction Motor for use where constant-speed high-torque single-phase motor is needed in large ratings. Typical applications include air and refrigeration compressors, pumps, stokers, etc ..... p 172

Rubber-Lined Valve suitable for slurries or dry pulverant material in air-transport lines. Can be fitted with manual or automatic controls ..... p 174

Annunciator designed for easy reading at a distance. Device is for surface or flush mounting ..... p 174

Rectifier Units for general purpose industrial applications. Standard units can supply constant or adjustable dc output voltages in ratings as high as 230v, 87 amp ..... p 177

Gear Speed-Reducer with output speed range of 1 to 1170 rpm with input speeds up to 1750 ..... p 177

Plastic Gear that's abrasive- and chemical-resistant ..... p 178

And Next Month ...

Double-Hung Refractory Arch that permits maximum arch movement without tile displacement. Pendulum-hung feature allows each belt of supported tiles to align itself.

For further data on above items use reply cards on page 190a, identifying your request with letter *P* and number

It was 1912—and the Girl Scouts of America were founded by Mrs. Juliette Low—when we introduced "Flexitallic", the *original* Spiral-Wound Gasket, and opened to Industry new fields of opportunity in the confining of fluids at high pressures and temperatures.

ENGINEERED TO AN EXACT STANDARD OF PERFORMANCE

Flexitallic Spiral-Wound Gaskets range in size from one-half inch to 104 inches . . . In price from a few pennies to hundreds of dollars . . . In application to pressures of 10 thousand pounds . . . For temperatures to 1800°F.

Each Flexitallic Gasket is engineered from the ground up for operation at specified temperatures and specified pressures—and to meet particular conditions of thermal and physical shock, corrosion, vibration and unusual joint stress.

The basic Flexitallic principle—the spiral winding of V-shaped spring-like metal plies alternating with plies of filler—lends itself naturally to almost unlimited variation.

The physical and chemical properties of the several metals, the different types of filler, the relation of filler to metal in the winding—all these are *variables* in the hands of the Flexitallic engineer.

Using the most precise instruments for determination of yield values, resilience and gasket density, the Flexitallic engineer builds each Flexitallic Gasket to an *exact standard of performance.*

Many Flexitallic Gaskets — originally designed as "specials" for oil refineries, chemical industries, power plants, shipyards, ship-operating companies — are now "standard" gaskets in the Flexitallic line.

If safe sealing is of serious concern to you, give us these facts on your gasketing requirements: (1) Fluid to be confined; (2) Type of Flange and dimensions; (3) Operating pressures and temperatures; (4) Bolting data.

In return we will send you a genuine Flexitallic Gasket. Test it severely—in your laboratory or on the job. Results will show you why most industries in the high-pressure, high-temperature fields are standardized on Flexitallic Spiral-Wound Gaskets.

FLEXITALLIC GASKET COMPANY
Eighth and Bailey Streets, Camden 2, N. J., U.S.A.

The name "Flexitallic" is the registered trade mark identifying the *original* (patented) Spiral-Wound Gasket. Now—for your protection and ours—this trade mark FLEXITALLIC is stamped into the outer ply of every *genuine* Flexitallic Gasket. Your guarantee of quality.

Someone's in for a Surprise!

A TOP-NOTCH OPERATING engineer got fired the other day, but I'm not worried about him. He's got another job already, and a good one. The fellow I do worry about is the man who fired him—the general manager.

This all happened in a fair-sized food-processing and distributing plant down South. Our operating-engineer friend had been with the company for over ten years in charge of both the power plant and all factory maintenance. During that time he set up such a smooth-working preventive-maintenance program that neither power plant nor factory production line has had a single shutdown from equipment failure for over eight years. That's mighty important in a plant handling perishable foods.

But maybe that record was too good. The company's general manager (who was no engineer and only recently got his present job after climbing up the distribution side of the business) decided to cut costs. First place he looked was the payroll. The operating engineer's three digit weekly salary seemed like a good place to start.

After all, he reasoned, the plant ran smoothly, never any trouble. There was a licensed operator on every shift in the power plant and the maintenance foreman could take care of the factory equipment. So he fired the operating engineer, and credited himself with making a worthwhile saving.

But you and I know that the general manager is in for quite a surprise. It's an old, old story.

First take the power plant. With no overseeing engineer, each shift operator will think of himself first, and gradually little jobs will get left for the next shift. Later on some jobs won't even get done until equipment begins to break down.

Then take factory maintenance. The maintenance foreman is on an hourly wage, gets time and a half for overtime. If he slips a little behind on the maintenance schedule set up by the former operating engineer, he won't worry too much. After all he's not paid to worry. And if a few minor troubles creep up, there's always overtime to fix things on—at time and a half. Then pretty soon these minor troubles come in bunches and production suffers.

Now you can't really blame the shift operators or the maintenance foreman. They had their hands full even with the operating engineer there to do the over-all supervision and planning. And after what happened to their former boss, are any of them going to try to take his place? I doubt it.

No, each one will do his day's work as before. But without a coordinator there'll be gaps and some things just won't get done. Breakdowns will cut into production. Replacement costs will creep up and up until . . .

Well, Mr. General Manager, you're in for a surprise!

George Edwards

Engineer

DOWELL SERVICE

CHEMISTRY APPLIED TO MAINTENANCE CLEANING PROBLEMS

Steel Company "P" asked: "Can you cut condenser operating costs?"

Dowell Service saved $87.92 in steam per day!

Dowell Service was used by a major steel company to clean a large turbo blower condenser. After the cleaning, operating figures showed a saving in steam of 8000 lb. per hour or a dollar saving of $87.92 per day. At this rate, *Dowell Service paid for itself in 5½ days!*

There are many places in every industrial plant where Dowell Service can be used to cut operating costs. Wherever deposits on the surfaces of condensers, boilers, heat exchangers, water lines and other equipment are stealing power, Dowell Service can show money-saving results.

Dowell Service has another prime advantage for the maintenance engineer. *It is fast!* Because cleaning is done chemically, time-consuming dismantling is eliminated. Dowell engineers fill the equipment with liquid solvents that go wherever steam and water flow. These solvents are designed to remove deposits quickly, efficiently and economically.

Do you have a cleaning problem, too . . . a place where deposits are causing a maintenance headache? Call Dowell. Skilled cleaning engineers are available for consultation at no obligation.

Other recent Dowell jobs:

In a large textile plant, the heating time required in kier heaters was cut one-third, following cleaning with Dowell Service.

•

Houdry catalyst cases cleaned by Dowell Service for a large refinery showed all tubes to be practically metal clean and orifices opened.

•

Thirty-three year old water well, cleaned by Dowell Service, showed increase from 64 to 130 g.p.m. with drawdown decrease of 27 feet.

CALL

DOWELL INCORPORATED · TULSA 3, OKLAHOMA

SUBSIDIARY OF THE DOW CHEMICAL COMPANY

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Richmond 19	St. Louis 8	Ft. Worth 2	Midland, Texas
Jacksonville	Indianapolis	Shreveport 69	Wichita Falls, Texas
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DOWELL

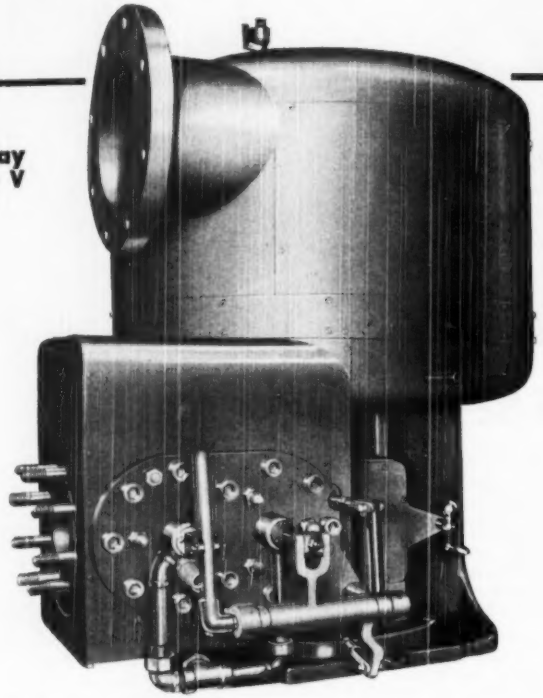
A SERVICE ORGANIZATION

WHY NOT TURBINE DRIVE?

Pumps, fans, compressors, special processing machines, in fact almost any machine requiring driving power can be fitted with an economical and dependable steam turbine driver selected from the many types available.

Steam turbines provide safety, low maintenance expense and ability to operate for long periods without inspection. Unsheltered installations are highly practical.

A large selection of types and frame sizes, special features and accessories are available on short delivery to suit your application.



Murray Type V

Among the newest in the Murray turbine line is the Type V vertical turbine, above. This machine provides completely enclosed construction, either direct-connected or geared for vertical pumps up to 600 HP and beyond. See that your new vertical pump is driven with a Type V steam turbine.

Contact your nearest Murray representative or write direct to—

MURRAY IRON WORKS COMPANY

BURLINGTON, IOWA

Builders of Steam Power Equipment for Three Quarters of a Century.

ELECTRONICS

(*Continued from page* 122)

operative so contact RE_3 stays open and as soon as start button is released start circuit is broken.

Grounded Electrode. A grounded electrode also prevents starting burners. The ground forms a low-resistance path for capacitor C to charge and discharge through, and no current flows through tubes T and T_1 so relay RE cannot close. For polarity shown in diagram, current would flow from S_2 on transformer, through C to flame electrode, through low-resistance ground to S_5 on transformer.

On reverse polarity, current flows in opposite direction through capacitor C. Consequently, capacitor charges and discharges without causing current to flow through tubes T and T_2, and relay RE cannot close, the same as for a broken electrode. This insures that equipment must be in condition to give proper protection or it cannot operate.

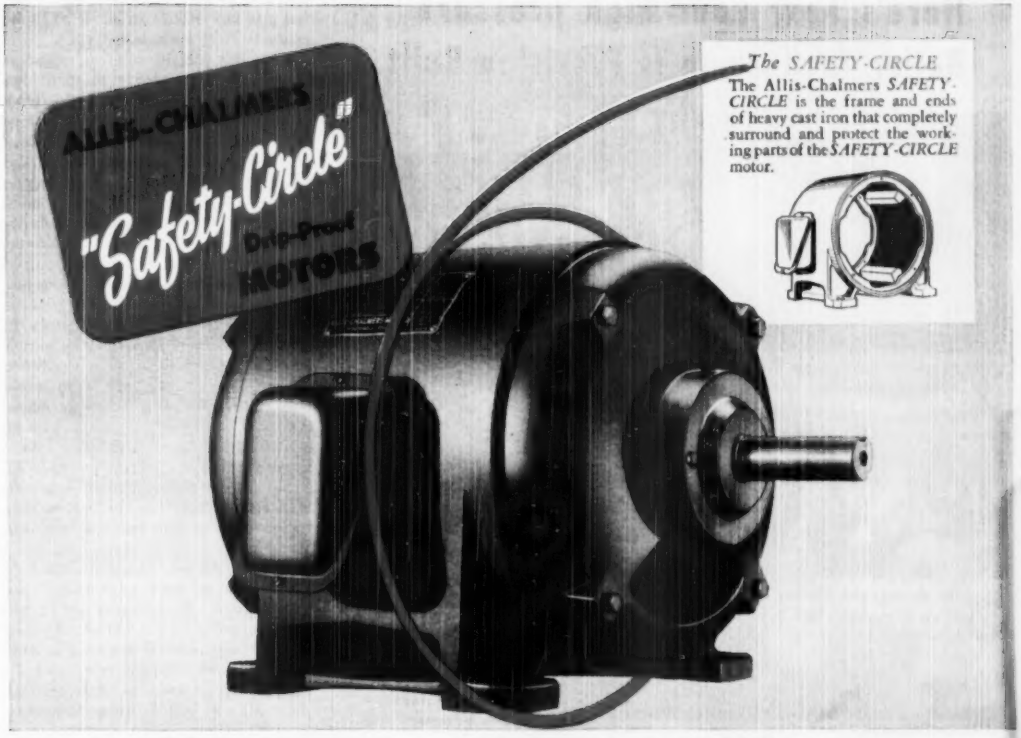
Flame Illumination. Fig. 3 diagrams a flame-failure protection system (Ess Instrument Co) that uses radiant energy (light) from the flame as its actuating medium. Phototube unit, Fig. 2, used to scan flame, includes phototube P, amplifying tube T and their resistors R to R_8, Fig. 3. Equipment in right-hand part of diagram is in indicator controller connected to phototube unit by three wires, A, B and C.

Mounting amplifier in same housing with phototube eliminates interference from magnetic waves or other stray radiation picked up by the leads unless a coaxial cable or other means is used to shield the microampere current of the phototube.

Output of amplifier goes through a meter and sensitive relay E. The meter shows flame condition, which is useful in burner adjustment. When best flame condition exists, meter gives a normal reading. Control panel also includes a timing relay using a gas-filled tube T_1. We will consider this relay first.

Time-Delay Relay. When switch S is closed, electronic circuits are energized. Assume top power lead + and bottom −. Current can now flow through primary of cathode-heating transformer CT. To ensure that tube T_1 will not be energized until its cathode is heated, relay coil E_3 is connected in series in heating circuit. Unless this relay closes, equipment cannot be put into service.

Tube T_1 circuit is open through push-button F. But a minus bias is applied to its grid through R_{10} and R_9 in parallel with capacitor C_3 to the grid and cathode, through R_9 to the + line. On reverse polarity, current can flow from top line through R_9 to cathode and grid of T_1, through resistor R_9, to charge



The SAFETY-CIRCLE

The Allis-Chalmers *SAFETY-CIRCLE* is the frame and ends of heavy cast iron that completely surround and protect the working parts of the *SAFETY-CIRCLE* motor.

SAFETY-CIRCLE means

★ All-Around Protection ★ Low Maintenance ★ Dependable Performance

A-3144

THE *SAFETY-CIRCLE* MOTOR is protected all around against those four great motor killers — corrosion . . . distortion . . . friction . . . foreign matter. The frame is of cast iron, the most corrosion-resistant material for this purpose.

The strength and stiffness of the cast iron is supplemented by ribbing and bracing to maintain alignment and prevent distortion. Ball bearings are lubricated and sealed at the factory. They require no attention for years. End brackets are drip-proof at no premium.

SAFETY-CIRCLE motors are fully protected inside, too. Multiple-dipped and multiple-baked stator plus extra inter-phase insulation provide extra protection against electrical breakdown.

With *SAFETY-CIRCLE* protection outside and protected working parts inside, you can count on years of trouble-free, low cost power.

For complete details on *SAFETY-CIRCLE* advantages, see your A-C Authorized Dealer or Sales Office or write for Bulletin 51B6210B. Stocked in sizes 1 to 20 hp. *SAFETY-CIRCLE*, *Texrope* and *Vari-Pitch* are Allis-Chalmers trademarks.

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ALLIS-CHALMERS

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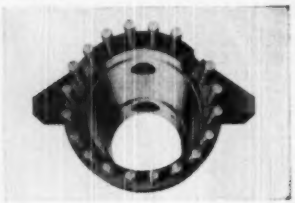
CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.

PUMPS — Integral motor and coupled types. Sizes and ratings to 2500 GPM.

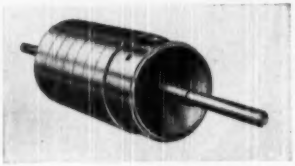
Here's how your high pressure Boiler Feed Pump is Precision Built by Pacific

1 The steel forging for the outer case is thoroughly annealed.

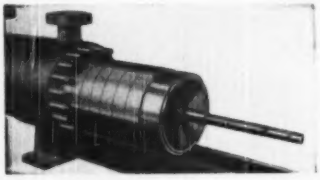


2 The outer case is precision finished.

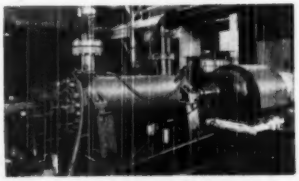
3 The diffusers and impellers are chrome alloy steel—impellers dynamically balanced.



4 The unitized internal assembly is assembled outside the case. All parts are precision finished.



5 The unitized internal assembly is installed in the outer case.



6 The pump is completely assembled—then performance tested.

7 Following test, pump is dismantled; checked; inspected; reassembled.

8 A precision-built, performance-tested, inspected Pacific Pump is on its way!

PACIFIC *Precision Built* PUMPS

Bulletin 109 Gives Details

Pacific Pumps inc.

ONE OF THE DRESSER INDUSTRIES

HUNTINGTON PARK, CALIFORNIA

BF-6 *Export Office:* Chanin Bldg., 122 E. 42nd St., New York ★ *Offices in All Principal Cities*

capacitor C_3 by grid rectification. (Note that grid now acts as an anode and tube conducts from cathode to grid.)

When line polarity reverses, capacitor C_3 will discharge slowly through high resistors R_9 and R_{10}. It will also tend, in series with the line volts, to discharge from grid to cathode and to + line. This gives grid a minus bias that keeps tube from firing. When top line is again minus, capacitor C_3 is once more charged by grid rectification to polarity shown. Gradually this capacitor becomes charged to line voltage.

Phototube and Amplifier. When bottom line is minus, phototube's circuit is through part of R_{11}, resistor R, tube P, resistor R_4 to line A. As long as burner is not lighted, tube P does not conduct. Under this condition, volts' drop across R is practically zero so voltage across to tube P is applied as a minus bias on grid of amplifying tube T_{12}. This bias is applied from line C through part of R_{11}, R from grid to cathode, through R_5 to A. Assume this bias blocks tube, then meter will read zero and red lamp will be dark.

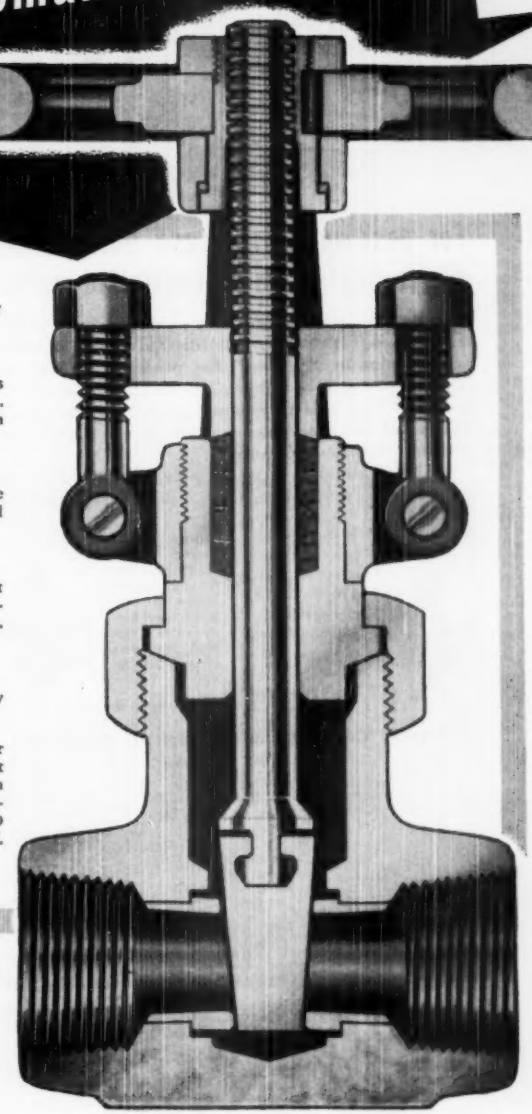
Lighting Burner. Assume switch S_1 is closed so oil-valve solenoid coil can be energized. Sounding of alarm bell shows power is on this circuit. To start burner, pushbutton F is closed to complete a circuit through relay coil E_2. This circuit is from — line, through pushbutton F, coil E_2, relay E_4 contact to + line. Relay E_2 closes its contacts. No. 4 contact bypasses pushbutton F so operator can release it and give his entire attention to lighting burner.

Oil-valve solenoid relay E_1 coil is energized from — line, through contact of cathode-heater relay E_5, No. 3 contact of E_2 relay and to + line. Relay E_1 opens contact No. 1 to break alarm circuit and closes contact No. 2 to energize oil-valve solenoid. This circuit is from — line through switch S_1, oil-valve coil, relay E_1 contact No. 2 to + line.

Assume burner lights immediately and sufficient light reaches tube P to cause it to conduct a normal current. This current flows through R, which has a very high resistance and causes a voltage drop that removes the bias from amplifier tube T. A normal current now flows through this tube from — line, cathode heater, cathode, anode, meter, relay E coil, to + line. Meter measures this current, which indicates flame's condition. Relay E closes its contact to complete a holding circuit for relay coil E_1 directly from — to + line to cut out timing relay.

Timing Capacitor. When button F was closed, capacitor C_3 was assumed to be charged to polarity shown. After button F is closed, capacitor is no longer charged by grid rectification, because circuit is now from top line through R_5, button F to bottom line. This shunts

Here's Why You Get Lower Maintenance Costs with Chapman List 960



1. *Gaskets!*
Available with either metal to metal or gasketed joint as required.

2. *50% Stronger!*
New design features compensate at points where excessive strain can develop . . . make stem and wedge gate connection 50% stronger than before.

3. *Wear-Resisting Wedge Faces!*
To keep your maintenance cost down the wedge faces are hardened to 800 Brinell by the exclusive Malcomizing process.

4. *Replaceable Seat Rings!*
When necessary, you can replace the seat rings easily . . . fast. Seat rings have wear-resisting and non-galling properties . . . made extra hard for years more service.

5. *Full Pressure Repacking!*
No need for costly interruption of flow to repack.

But check this lower maintenance cost for yourself. Next time you buy specify List 960 in sizes from ¼" to 2". Rising stem with yoke (as illustrated) or rising stem inside screw type. For pressure range 2000 lbs. at 100 deg. F., 380 lbs. at 1000 deg. F. Specify List 990 for higher pressures.

The CHAPMAN Valve Manufacturing Company

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Accurate pressure regulation!

FOR HEATING OR PROCESS JOBS:

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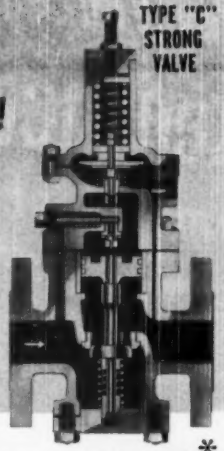
- ...where dependability is essential.

TYPE "C" STRONG VALVE

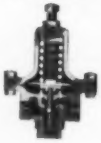


For positive control, use this STRONG* single-seated, pilot-controlled valve!

Simple design, extra-heavy construction make STRONG's Type "C" regulating valve give trouble-free regulation. Semi-steel for pressures to 250 psi, 450° F.; cast steel to 600 psi, 750° F. With Anum-Metl† seat and disc, this valve automatically adjusts itself to control the flow of steam, air or gas required to maintain reduced pressure.

Write us about your pressure reducing problem or request our complete steam specialties Catalog 68-P.

TYPE "O"



Direct operated. Semi-steel construction suitable for initial pressures to 225 psi, 400° F. For steam, air, water or gas.

Features internal strainer, Anum-Metl† seat and disc. Direct operated, of extra heavy semi-steel, this valve is suitable for pressures to 225 psi, 400° F.

TYPE "K"

*Trade Mark Reg. U. S. Pat. Off.

STRONG, CARLISLE & HAMMOND COMPANY

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† ANUM-METL Reg. Trade Mark

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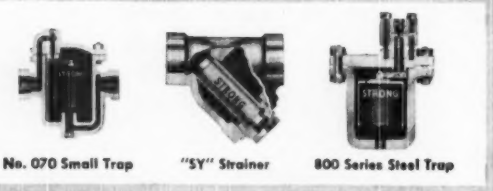


No. 070 Small Trap — "SY" Strainer — 800 Series Steel Trap

STRONG

cathode and grid of tube T_1 out of circuit as long as contact 4 remains closed on relay E_2.

Capacitor C_3, however, discharges through resistors R_9 and R_{10}. It also tends to discharge from grid to cathode of tube T_1, contact 4 to bottom line, and + on C_3, to hold a minus bias on grid. Gradually, charge of C_3 is dissipated through R_9 and R_{10}, and when its voltage drops below critical bias of T_1, this tube fires.

This circuit is from — line through contact No. 4, cathode to anode of T_1, resistor R_7, relay coil E_4 and to + line. Relay E_4 contact opens and breaks circuit through relay coil E_3. When contact No. 4 opens, it breaks shunt around pushbutton F and opens circuit through T_1, so relay E_4 contact closes. T_1 cathode heater remains energized and capacitor C_1 is again charged by grid rectification, as previously explained, ready for next timing cycle.

Timing relay prevents hazardous conditions developing when lighting burner. If burner does not light within a safe period, relay E_4 opens, which in turn causes E_2 to open its contacts and de-energize relay E_1 to close fuel valve. Red lamp goes dark and alarm sounds to call fireman's attention.

If, after burner is ignited, flame goes out, phototube P stops conducting. Minus bias on tube T then increases to where current through relay E coil becomes so low its contact opens and breaks circuit through E_2. This causes fuel valve to close and sounds alarm.

Capacitors C_1 and C_2 have fairly large capacity so they serve not only to prevent vibration of their relay contacts but also to act as a timer on the relays. They supply current necessary to hold relay closed in case of a short flame interruption. This prevents shutting fuel valve because of a puff or other temporary conditions in the furnace.

Flame-failure protection, Fig. 3, is used in plants where a fireman is in attendance and serves as an alarm to call his attention if fire fails. Then he can immediately do something to avoid a shutdown and restore normal operation.

Next article will continue the study of flame-protection devices and will explain operation of a system that is actuated by flame rectification on the pilot flame and by a phototube on the main flame.

TV ANTENNAS

(*Continued from page* 85)

be added at a later date, consult manufacturer before initial installation. There is never any difficulty in adding FM. But since AM signals are of much lower frequency, special distribution components must sometimes be used. Some

FOR P·G·and E·

The Kern Steam Plant and the extension to Station P of the Pacific Gas and Electric Company represent the finest examples in the country of centralized control in steam power stations.

The Kern Steam Plant, with an installed rated capacity of 175,000 kw, recently completed for the Pacific Gas and Electric Company in Kern County, about 300 miles south of San Francisco in the San Joaquin Valley.

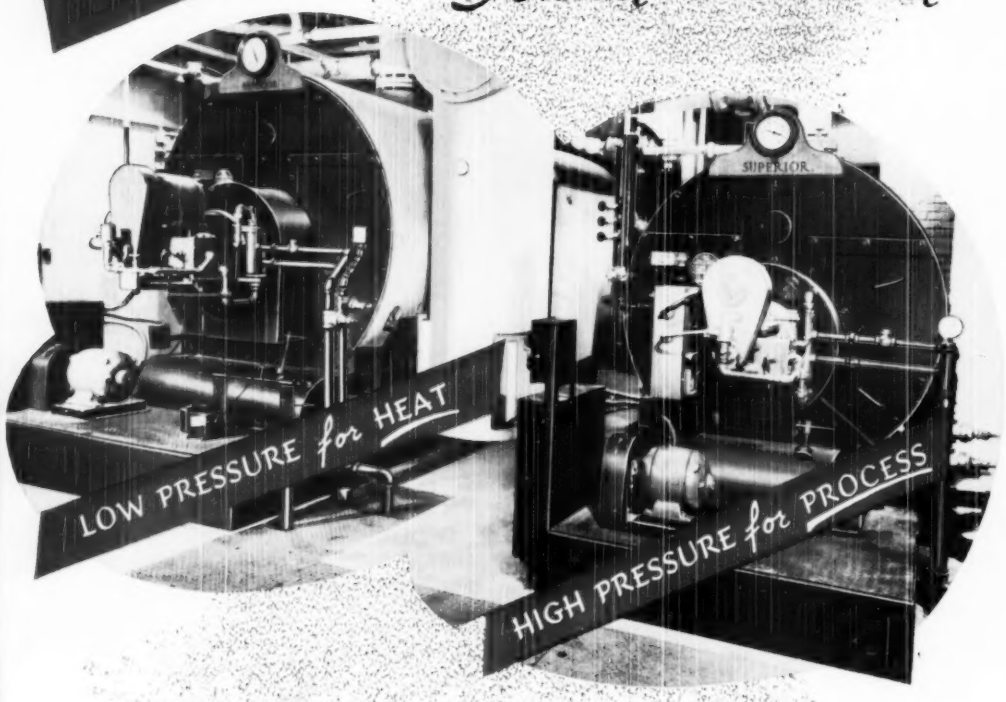
The extension to Station P, with an installed rated capacity of 222,000 kw, designed and constructed by Stone & Webster Engineering Corporation for the Pacific Gas and Electric Company at Hunters Point, San Francisco.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER, INC.

Superior STEAM GENERATORS

at the PHILADELPHIA Textile Institute



In search of new techniques and lower operating costs (of which cost-of-steam is an important factor) the Philadelphia Textile Institute conducts constant research for the Textile Industry . . . and for their new Scholler Laboratories, where much of this research is carried out, Superior Steam Generators were chosen because of their recognized economy of operation and low cost steam production. The two units shown supply heat for the entire building and process steam for Scholler Laboratories, as well as for Althouse and Burlington Laboratories. If you use steam for heat or process, you'll want the details given in Superior Steam Generator Catalog 201.

18 sizes from 20 to 600 bhp. • Fully automatic with any grade of oil, gas, or both. • More than 80% thermal efficiency guaranteed.

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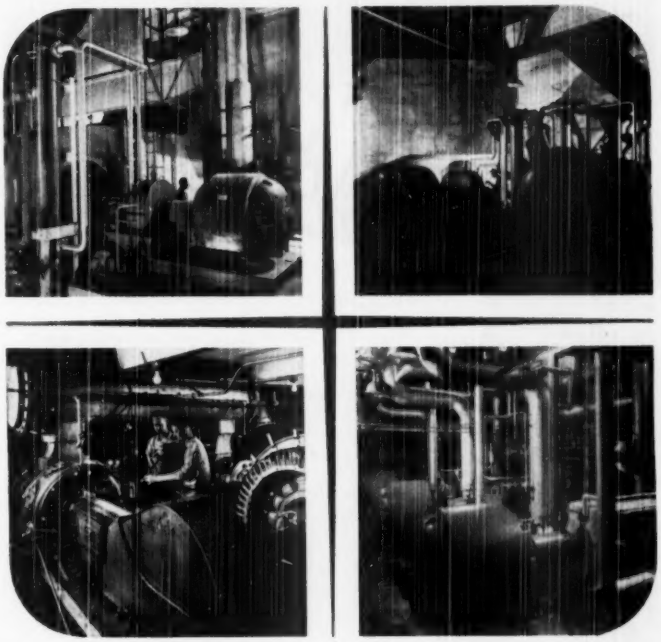

Here's an oil that can save you a lot of maintenance dollars! The new improved Gulf Harmony Oil provides outstanding protection for pumps, compressors, motors, fans, and other oil-lubricated plant equipment. Also ideal for hydraulic applications.

Gulf Harmony Oil is enriched with a remarkable new oxidation stabilizer—another important Gulf Research development. This additive improves the already outstanding chemical stability of Gulf Harmony Oil—gives it exceptional resistance to sludging. This means cleaner reservoirs, hydraulic systems, and antifriction bearings and it outlasts competitive oils.

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For more complete information on Gulf Harmony Oil, call in a Gulf Lubrication Engineer today. Write, wire or phone:

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TO SAVE-TO SELL

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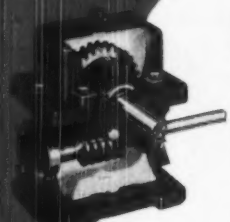
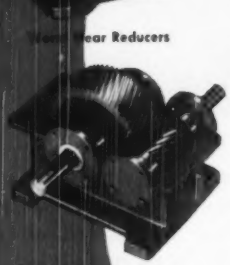
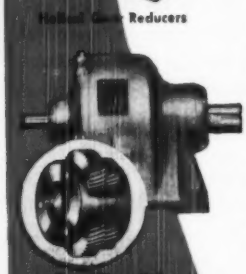
SPEED REDUCERS

Designing machines to embody standard components is naturally a cost-saving, time-saving factor . . . but of equal importance—a vital *selling* factor.

In selecting speed reducers, like other accessories with moving parts, this is particularly true. Design engineers can not afford to lose sight of the user who, from the very beginning, likes to know that he won't be faced with the delays of custom fabrication, should replacements become necessary.







This is one of the major reasons so many manufacturers build-in Winsmith Speed Reducers. They know that any speed reduction needs up to 85 H.P. can be met *at savings* with a fully standardized unit. Looking out for their customers, they know that when parts may be required, they'll always be available . . . on short notice . . . out of stock . . . and like complete units, will slip into position as easily as a nut or bolt, with no alignment problems.

Thus, alongside famous names in bearings, motors and other accessories listed in machinery manufacturers' catalogs, it is common to find Winsmith Speed Reducers. Such products improve performance. Such names help to sell.

Yes, to save in manufacturing costs . . . to help sell more machines . . . Winsmith Speed Reducers belong in the original package. Winsmith's power transmission engineer in your territory welcomes the opportunity to tell you why . . . *more specifically.*

Free Catalog Handbook No. 148 with complete engineering data. Write.

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SPRINGVILLE (Erie County), N. Y.

amplified systems make no provision for AM. A few non-amplified systems provide for it. So consult the equipment manufacturer while still in the planning stage.

Is there any technical problem connected with carrying TV, FM and AM lead-ins in one conduit from the roof or amplifier to points of distribution throughout the building?

When all three are provided by one antenna system only one coaxial cable is necessary. And if systems are separate there is no reason why both cables cannot be carried through the building together provided conduit is large enough. Since coaxial cable is shielded it is not affected by anything in its vicinity.

What TV interference, other than that from nearby receiver-oscillators, can be expected and how can it be eliminated?

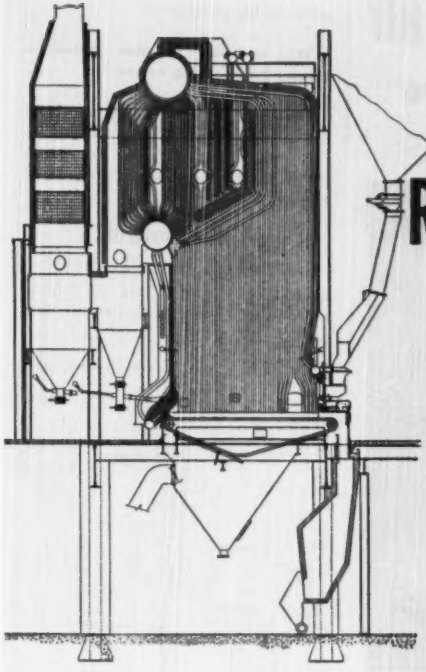
Additional interference can arise from neon lights, automobile ignitions and other pulse-type electrical devices. Such interference is greatly reduced or eliminated by systems using individual channel amplifiers since transmission through system is limited to channels to which amplifiers are tuned.

Interference may also arise from radio transmitters, particularly amateurs in the 10-meter band. There is no way of elminating interference occurring on the same frequency as TV signals except by turning the antenna. There are many cases of interference not transmitted through the antenna but direct to the receiver. Best way to eliminate this is with coaxial cable between receiver and antenna outlet. And in some severe cases the receiver chassis itself may have to be shielded with tinfoil.

Does the basic problem vary depending on whether master antenna system is to be installed in a hotel, institution or department store?

Technically, basic problem does not change. Physical arrangement of components and outlets is often different in stores, however. Closeness of receivers in store sales areas causes direct pickup by one receiver of oscillator radiation from others nearby. This can be reduced or eliminated only by a system which (1) is entirely shielded right up to the receiver and (2) sends so strong a signal to receivers that contrast control need be only barely opened. Systems like RCA and Jerrold are suitable. However in high-signal areas other types are equally effective.

As mentioned previously a system with tapped risers (like RCA) is often

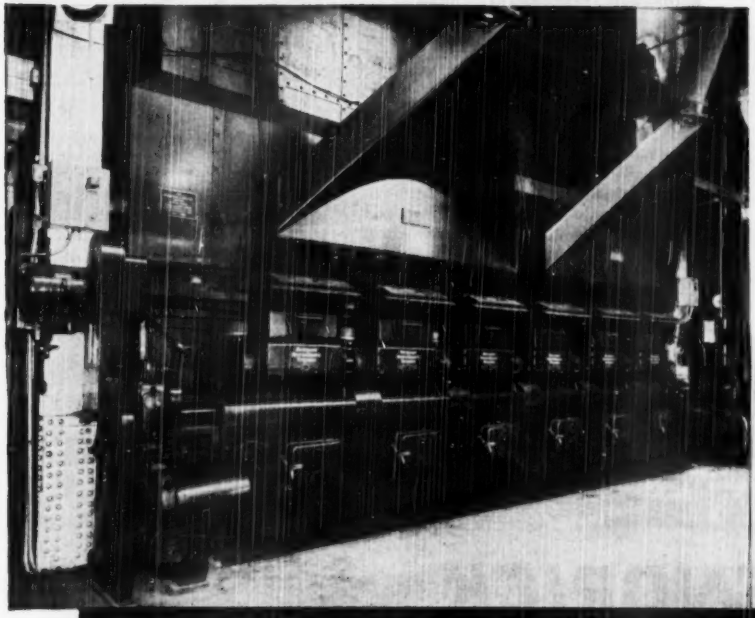


RotoGrates Bought Twice For Erie

General Electric Company twice selected Detroit RotoGrate Stokers for their Erie, Pennsylvania, plant. First Unit —150,000 pounds. Second Unit—175,000 pounds. Both modern installations are with Babcock and Wilcox Steam Generators.

Detroit RotoGrate is an improved spreader stoker in which grates move slowly forward, automatically discharging ash at the front. Economically burns all grades of Bituminous Coal or Lignite. Higher burning rates produce more capacity per foot of furnace width, keeping down investments in both steam generating equipment and building. Thermal efficiency is exceptionally high . . . either with steady or fluctuating loads.

It will pay you to investigate the RotoGrate.



There is a type and size of Detroit Stoker for every Industrial and Power Need

DETROIT STOKERS

DETROIT STOKER COMPANY

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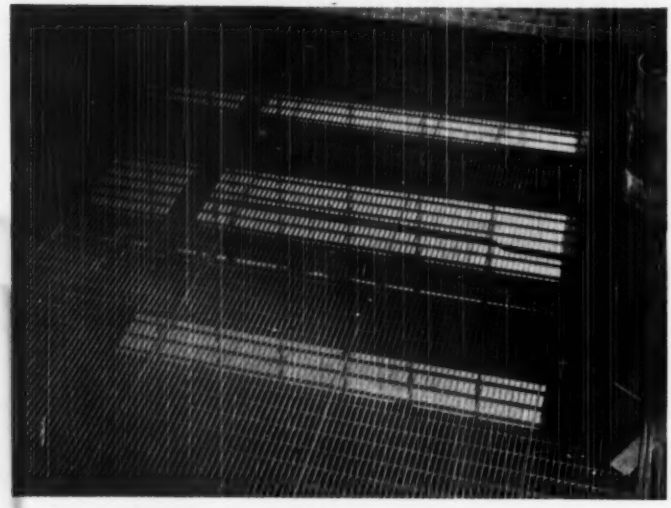
Where you need light and air

use Hendrick Open Steel Flooring with its 90% open area



PLENTY OF LIGHT AND AIR THROUGH THREE FLOORS

With its minimum obstruction to the passage of light and air, Hendrick Mitco Open Steel Flooring will support heavy loading without any lateral deflection of the steel bars.

Made into integral panels, under hundreds of tons of hydraulic pressure, there are no bolts, rivets or angle irons to loosen, or to collect dirt or refuse—no welds, liable to have residual stresses and lead to warping.

* * *

Unequalled for floors, loading platforms, ramps and driveways that have to withstand heavy traffic, Hendrick Mitco Amorgrids do not depend on the fill for development of full strength to resist shock loads.

The rectangular, square-edge bars provide a thoroughly safe, non-slipping, level walking surface.

For stairs, ladders and fire escapes, Hendrick Shur-Site Treads offer all the advantages of Mitco construction. A valuable safety feature is a heavy, flanged nosing-bar that gives sharp visibility to the edge of each tread and also provides additional strength where the load is greatest.

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"Shur-Site" Treads and
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preferred for hotel work since it simplifies cable installation.

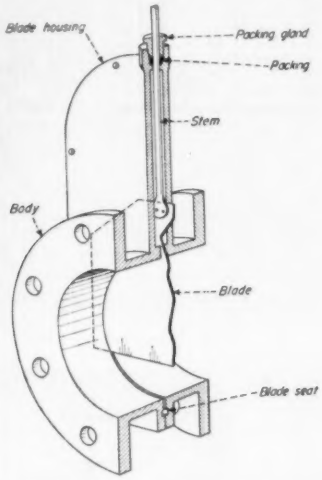
Will a master antenna system increase the lightning hazard?

Generally it's just the reverse. Most system antennas are grounded or, as with the Brach *Mul-Tel*, use special lightning arrestors. Hence antennas act as lightning rods.

Diesel Controls

(*Continued from page* 101)

slide valve is shown in Fig. 10. A blank disk between flanges is sometimes used.



10 Construction of typical slide valve sometimes employed in exhaust pipes

Fully automatic plants, with several engines connected to the exhaust pipe, as may be the case in city buildings, form a special case. Here exhaust cutoffs must be automatic. Such plants use swing valves operated by solenoids and so arranged that exhaust pressure from engine helps solenoid hold valve open.

So much for the exhaust system. Now let's turn briefly to the intake.

AIR INTAKE SYSTEM

An internal-combustion engine needs a full supply of air, otherwise it can't deliver full power and burn its fuel efficiently. Instruments in the intake system are thus used mainly to prevent air starvation.

Many types of intake air filters get dirty gradually. Resulting increase in pressure drop reduces air volume to engine. Filter condition may be checked readily by a simple U-tube, water-filled. This shows when filter needs cleaning.

(*Continued on page* 214)

Eagle-Picher Insulation can help you get maximum heat and power from each fuel dollar expended

Here's insulation that will save you money

EAGLE-PICHER DE-85 BLOCKS

A highly efficient, rigid-type insulating material composed almost entirely of pure, lightweight, Eagle-Picher Diatomaceous Earth. High physical strength enables these blocks to stand up under usage normally encountered in installation. Adaptable to virtually all types of heated equipment. Can be cut with a knife, or sawed, to fit irregular shapes. DE-85 Blocks for temperatures to 1300°F. DE-95 Blocks for temperatures to 2000°F.

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Finishing cement for temperatures up to 1000°F. Adheres tightly to hot or cold surfaces with practically no shrinkage. Highly durable. Gives a smooth, hard, light-colored, paintable surface.

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Effectively seals against air infiltration through boiler settings — seals cracks and pores, effects substantial fuel savings. Great adhesive strength, retains its elasticity. For temperatures up to 400°F.

An Eagle-Picher Industrial Insulation distributor or representative can help you reduce operating expenses because he has available a wide line of insulation products — for high and low temperatures — scientifically designed for maximum thermal efficiency, and practical application. Why not let him give you more information about some of the products listed here?

These Eagle-Picher products can save you money . . . power . . . time

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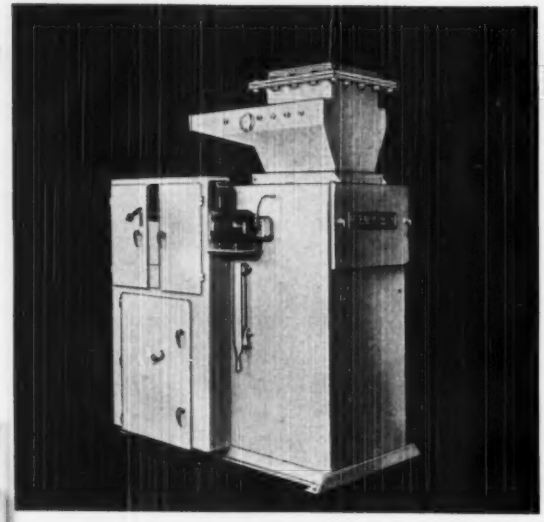
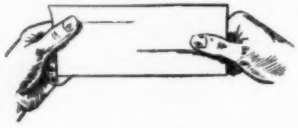


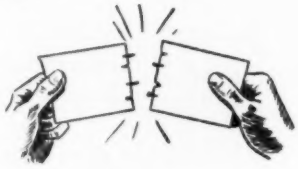
ENDLESS FEED BELT ASSURES RELIABLE OPERATION OF S-E-CO. COAL SCALES

S-E-Co. Coal Scales are equipped with an endless feed belt which has no point of weakness. To demonstrate the great strength of an endless belt, try this yourself.

Cut a piece of paper into a strip 3" wide by 10" long. Pull it hard—note its strength.



Now cut two pieces 3" wide by 5" long and join them together with staples. Pull this spliced strip just a little and it pulls apart.



Only endless belts have enough strength for reliable coal scale operation.

Write for bulletin

STOCK EQUIPMENT COMPANY

715P Hanna Building • Cleveland 15, Ohio

EQUIPMENT NEWS

(*Continued from page* 148)

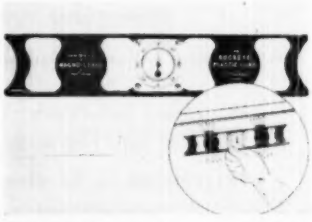
in a gland shaped in conventional way. *Teflon* flows very slightly under pressure to maintain its seal.

Pittsburgh Equitable Meter Div, Rockwell Mfg Co, 411 N. Lexington Ave, Pittsburgh 8, Pa.

WELDING SHIELD **P922**

A specialized 18-inch welding shield designed for getting into offset or close places, *Weldiscope* consists of conventional fibre shield with a periscope. Device gives a true picture and not a reverse one such as you get with mirrors.

Industrial Products Co, 2820 N Fourth St, Philadelphia 33, Pa.



MAGNETIC LEVEL **P923**

Permanent *Alnico* magnets are made a part of the 9x2-in., 10-oz *Magno-Level* so that it sticks to pipes or flat ferrous surfaces. It leaves the workman's hands free for lining up, straightening or fastening work in place. The level has a clock-faced angle gage to determine any angle from 0-360 degrees.

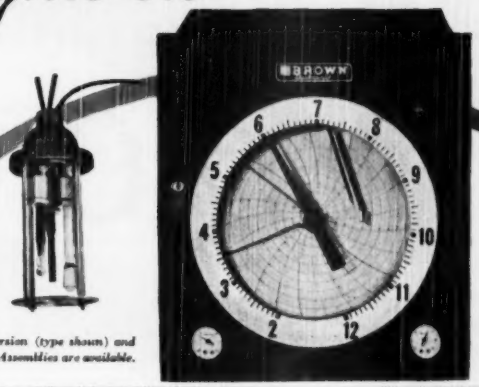
Buckeye Plastic Corp, 1220 Huron Road, Cleveland 15, Ohio.

CLUTCH-TRANSMISSION **P993**

Two-speed automatic transmission; 20-hp capacity with minimum input speed of 900 rpm. Unit is made up of two over-running clutches, one engaging in a clockwise and the other in a counter-clockwise direction. By reversing the motor two speeds are provided; one at direct motor speed and the other at a pre-selected reduction without changing direction of rotation of output shaft.

In 20-hp model low limit of reduction is

Set Your Sights on



Immersion (type shown) and Flow Assemblies are available.

PROCESS IMPROVEMENT...

MORE ECONOMICAL USE OF CHEMICALS...

LONGER EQUIPMENT LIFE...

WITH...

THE *ElectroniK* pH CONTROLLER

With efficient operation as a moving target, many operators throughout industry are loading their guns with extra ammunition . . . by providing control for every important variable. In such cases, automatic pH control is gaining recognition as a cost reduction factor . . . and justly so! Proper control of pH can have startling results. It is vital to the stabilization of process variations, to the chemical treatment of raw and waste water, and to the useful life of production equipment.

No matter what your application, the *ElectroniK* pH Controller will prove its value in a very short time . . . through unusual sensitivity to prevailing conditions, accurate and permanent record, rapid response and automatic control action.

Call in your local Honeywell engineer for a discussion of your particular pH requirements . . . he is as near as your phone.

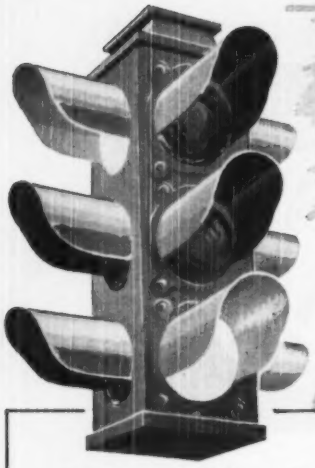
MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4490 Wayne Ave., Philadelphia 44, Pa. Offices in more than 80 principal cities of the United States, Canada and throughout the world.

Write, today, for a copy of Catalog 15-12.

FOR BETTER PROCESSING

Honeywell

BROWN INSTRUMENTS



DRAFT FANS

GO

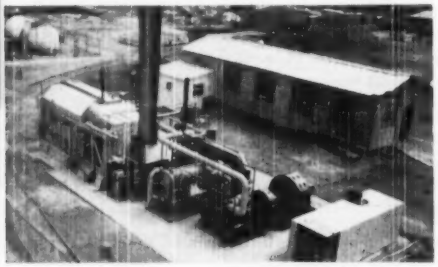
on GREEN

Packaged Boilers Deserve Good Fans, Too!

The same engineering talents and the same careful construction go into the many stack supporting draft fans we have designed for the so-called "packaged" boilers. In some ways, engineering faces more difficult design problems because of the utmost efficiency required in a relatively small space.

Green Stack Supporting Draft Fans are practical, too. They are readily accessible for inspection and maintenance. Shafts and wheels are removable endwise without disturbing the stack or other structural members.

To those manufacturing "packaged boilers" or to those operating them with fans that don't seem to be doing the proper kind of a job or where maintenance seems too high, we offer the services of our experienced fan engineers to (1) design fans suitable for the boiler or (2) study the problem and recommend the remedy.



Our New Bulletin 168 gives details of our Stack Supporting Draft Fans. Write for a copy.

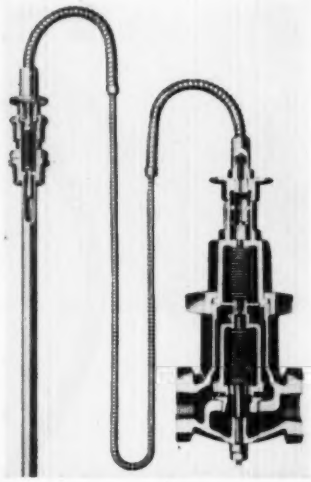
THE GREEN *Fuel Economizer* COMPANY INC.

BEACON 3, NEW YORK

ECONOMIZERS • FANS • AIR HEATERS • CINDERTRAPS

6 to 1. But any pre-selected ratio from direct motor speed to this low limit is obtainable. Other models of this transmission are available to handle 5- to 50-hp motors.

Western Mfg Co, 3400 Scotten Ave, Detroit 10, Mich.



TEMPERATURE REGULATOR P917

Self-operated, hermetically sealed temperature regulator, the *Stacon,* is intermediate in its field of application between direct-operated and air-operated regulators. It operates on the vapor-flash principle.

Liquid in the control bulb expands with increase in ambient temperature and is forced into a steam-jacketed power bellows where it flashes to vapor. The pressure released extends the bellows and moves attached disk toward valve seat, throttling the valve.

Farris Stacon Corp, Palisades Park, N. J.

AC WELDERS P991

Welding-heat adjustment in this transformer unit is handled electrically through ac-dc reactor. Transformer has conventional primary and secondary windings plus additional winding that supplies

How to keep a lift truck from letting you down

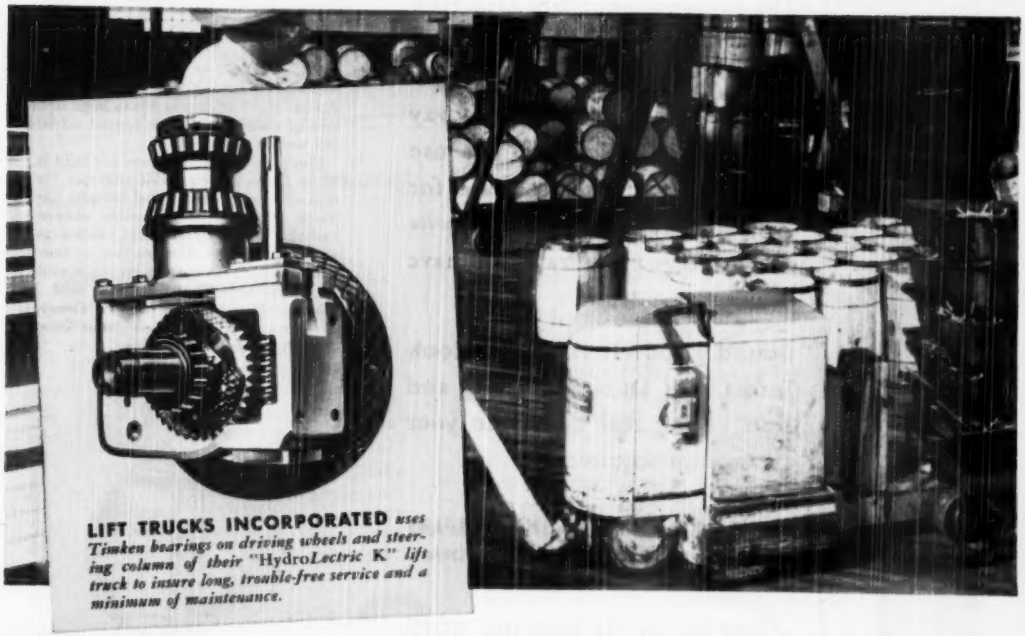
THIS "Hydro*Lectric* K" motorized lift truck, engineered by Stuebing and built by Lift Trucks Incorporated, Cincinnati, gives you all three of these features: two front driving wheels, dynamic brake, and power lift. To assure long life, permanent alignment and easy steering, the drive wheels and steering column are mounted on Timken® bearings.

Due to the tapered construction of Timken bearings, radial and thrust loads can be carried in any combination. Shafts are held in rigid alignment which reduces wear on surrounding parts. Line contact between the rollers and races provides maximum load-carrying capacity.

Timken tapered roller bearings are manufactured to extreme precision and finished to incredible smoothness, making friction practically negligible. They permit tighter closures that keep out dirt and retain lubricants longer. Maintenance time and materials are minimized. Normally, Timken bearings last the life of the machine because they (1) are engineered for the job, (2) are made of Timken fine alloy steel, (3) are precision manufactured.

No other bearing can give you *all* the advantages you get with Timken bearings—backed by over fifty years of bearing research and development. Specify them in all the machines you buy or build. And remember to look for the trade-mark "Timken" on every bearing you use. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



LIFT TRUCKS INCORPORATED *uses Timken bearings on driving wheels and steering column of their* "Hydro*Lectric* K" *lift truck to insure long, trouble-free service and a minimum of maintenance.*

WE MAKE OUR OWN STEEL

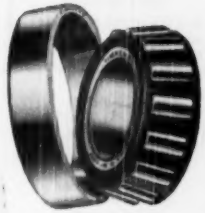
The special grade alloy steel which gives Timken bearings their strength and resistance to wear, is made in our own steel mills.

The Timken Roller Bearing Company is the acknowledged leader in: 1. advanced design; 2. precision manufacturing; 3. rigid quality control; 4. special analysis steels.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



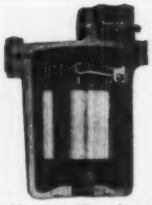
NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▱ BEARING TAKES RADIAL ◫ AND THRUST ⋯◫⋯ LOADS OR ANY COMBINATION

Anyway you figure it....

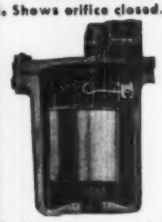
You get TWICE the VALUE with...

Clark DUO-STEP Leverage STEAM TRAPS

HERE'S HOW DUO-STEP WORKS:



1. Shows orifice closed.



2. First fulcrum point "cracks" orifice.

3. Second fulcrum point moves valve from orifice.

The amazing new Clark Duo-Step design actually *doubles* the drainage capacity of Clark Steam Traps. This means *double value* anyway you figure it. Now you can use smaller, less expensive traps for larger drainage jobs or get *twice* the drainage from traps you have been using.

Sound good? It is! Better look into Clark Duo-Step *today* and start saving real money on your steam trap requirements.

THE CLARK MANUFACTURING COMPANY
1831 East 38th St., Cleveland 14, Ohio

GET THE WHOLE AMAZING STORY, SEND FOR THIS BOOKLET -Today!

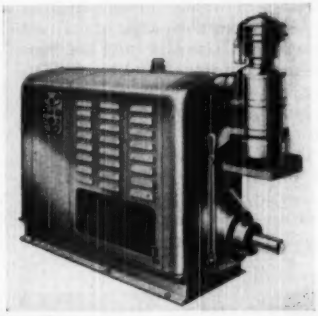
DUO-STEP Leverage

Clark FLUID CONTROLS

current through a rectifier for reactor adjustment.

Sets can be furnished for operation on single phase, 60 cycle, either 220/440-v, 440/550 or 220/440/550-v. They can also be furnished for 60-cycle operation if needed. Units are available in 200-, 300-, 400- and 500-amp sizes with stationary or portable mountings.

Hobart Bros Co, Hobart Sq, Troy, Ohio.

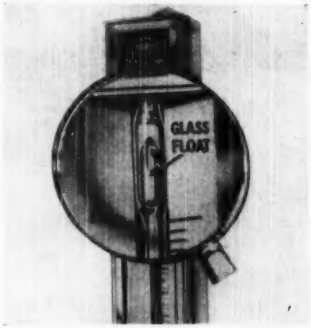


LIGHTWEIGHT DIESEL P970

Designed for jobs needing a lightweight engine, this 6-cyl 2-cycle unit is rated at 275 hp. The "*110*" is adapted to large earth-moving vehicles, general industrial, oil-field and marine equipment.

Blower-scavenged, cylinders are 5x5.6-in., 92 psi bmep. Rated speed is 1800 rpm. Unit injectors pump, meter and atomize fuel. Block and head are reversible one-piece castings, permitting choice of rotation and accessory location. Construction is heavy-duty with all wearing parts replaceable. Customary forced-feed lubrication used.

Detroit Diesel Engine Div, General Motors Corp, 13400 West Outer Drive, Detroit 28, Mich.



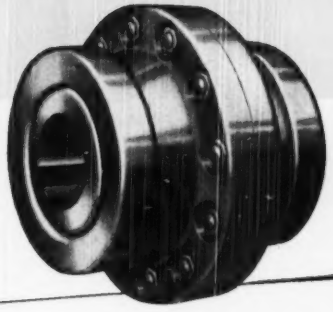
OVERFLOW CHECK VALVE P979

All-glass overflow check valve is designed to prevent loss of indicating gage or manometer liquid from pressure surges. Suitable for hydrostatic instruments of all kinds. Can be made integral with some gages and manometers.

Unit consists of glass float check in glass cylinder. Cylinder has seat at top opening and glass tube below for connection to instrument. Mating surfaces of float and cylinder are ground and lapped. Indicating

GOT A COUPLING PROBLEM?

SHEAR PIN?
FLOATING SHAFT?
LOW SPEED?
CUT OUT?
HEAVY DUTY?
REVERSING?
HIGH SPEED?
LIGHT DUTY?



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No matter what size couplings you need—whatever the service—*see Koppers first!* Because only Koppers offers you Fast's Couplings, *proved* the best insurance for coupling problems you can buy! For 30 years, Fast's have been industry's standard for *low-cost, trouble-free* coupling operation.

When you specify Fast's you get the benefit of Koppers Engineering service, acknowledged finest available. Koppers engineers, backed with *30 years* of Fast's Coupling experience, study your problem. Then show you *which* Fast's Coupling you need (and more important) *why you need it!*

Take advantage of Koppers long-term coupling experience. Buy Fast's Couplings and get Koppers *valuable* Engineering Service—a service you cannot buy, but which Koppers offers without obligation. The Fast's Catalog contains full details. Mail coupon for your copy today!

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UNSURPASSED ENGINEERING . . . Koppers' engineers are acknowledged the best in the industry. Their practical knowledge, backed with 30 years' coupling experience, is at your service!

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LOWEST COST PER YEAR . . . Fast's Couplings will outlast equipment they connect if properly maintained. Their cost may be spread out over 25 years or more, offering you lowest coupling cost per year!

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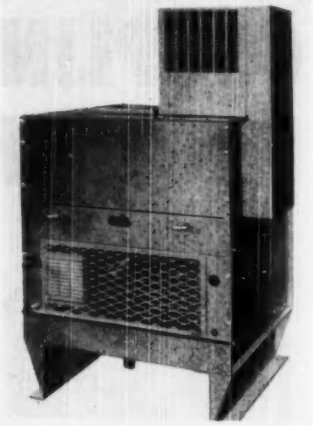
liquid wets seat for liquid seal. Made entirely of glass; dirt and defects are easily observed.

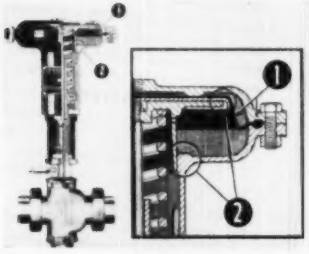
King Engineering Corp, Box 300, Ann Arbor, Michigan



EVAPORATIVE CONDENSERS P933

Floor-mounted, copper-coil evaporative condensers, a new line for this manufacturer, have been put out in three sizes, 3½, 6 and 12-ton units. They are compact, have removable front panels, and front-mounted connections for refrigerant and electricity. Low air velocity does away with need for air eliminators.

McQuay Inc, 1600 Broadway, NE, Minneapolis, Minn.



FLOW-CONTROL VALVE P980

Diaphragm operated for pressures below 250 psi, *Flowrite* valve is suitable for regulating steam, water, oil and gas flow. Valve is air or water operated. *Neoprene* diaphragm (1) has positive sealing bead giving increased sealing with rise in control pressure. Piston-plate assembly (2) has free-floating thrust plate to absorb side thrust. Bodies may be single or double seat, double unions and flanged ends, direct and reverse acting and 3-way valves. Stainless steel and bronze trim.

Powers Regulator Co, 2771A Greenview Ave, Chicago, Ill.

COOLING TOWER P914

High heat transfer, great ruggedness, easy access to all parts, weatherproof construction are reported features of this line

BEACON COAL

EASTERN GAS AND FUEL ASSOCIATES

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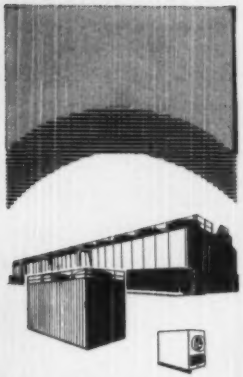
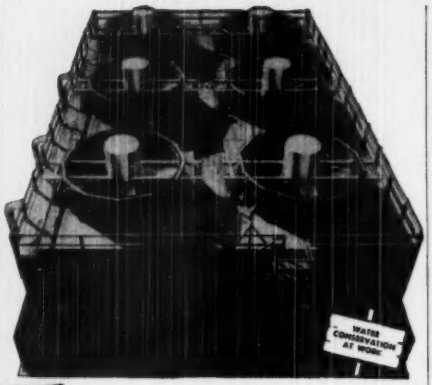


COOLING TOWERS



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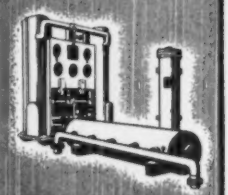
INDUSTRIAL COOLING TOWERS Help You Save Water!

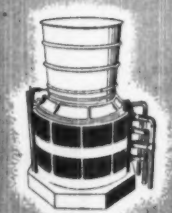


GAS EQUIPMENT

Wherever heat is to be dissipated to the atmosphere, you can depend on a Pritchard Cooling Tower to do the job more efficiently and economically at *water savings up to 99% over former wasteful methods!*

Adequately sized, thoroughly engineered and manufactured of highest quality materials, Pritchard Towers are guaranteed to meet your peak as well as your normal load requirements. Wherever you see a Pritchard Cooling Tower, you see water conservation at work.

Consult your nearby Pritchard representative for the solution to your water conservation problem.



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of induced-draft refrigerant cooling towers.

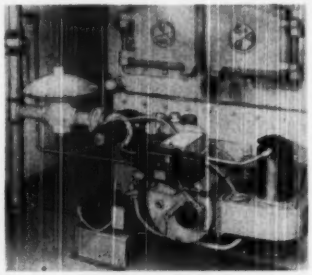
Separate banks of nozzles at top and bottom of the spray section oppose each other and enable water to travel farther before reaching the sump. Nozzles are brass and spray without misting. Units are available for use with 3, 5, 7½ and 10-ton refrigeration condensers.

U. S. Air Conditioning Corp, 3377 Como Ave, S.E. Minneapolis 13, Minn.

FIRE DETECTOR P951

A protection block, called the fire protection system *FD-10*, consists of six detectors and one control panel covering areas up to 120 by 80 ft. Detectors operate on a photoelectric principle and are connected in a series circuit, mounted directly on any standard 3 in. outlet box.

Fireye Corp, 77 Broadway, Cambridge 42, Mass.

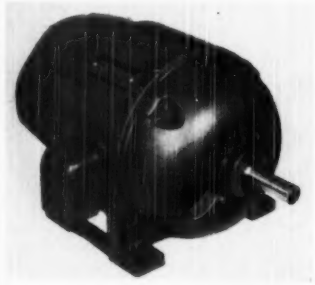


PACKAGED BOILER P925

packaged boiler comes in two sizes cover-

Dual-fuel, *Flame King Series 116 DF* ing a range of 1½ million to 3¾ million Btu input for industrial or commercial heating or processing. It burns No. 3 oil or lighter, and natural gas. Unit has electronic controls and flame-safety devices.

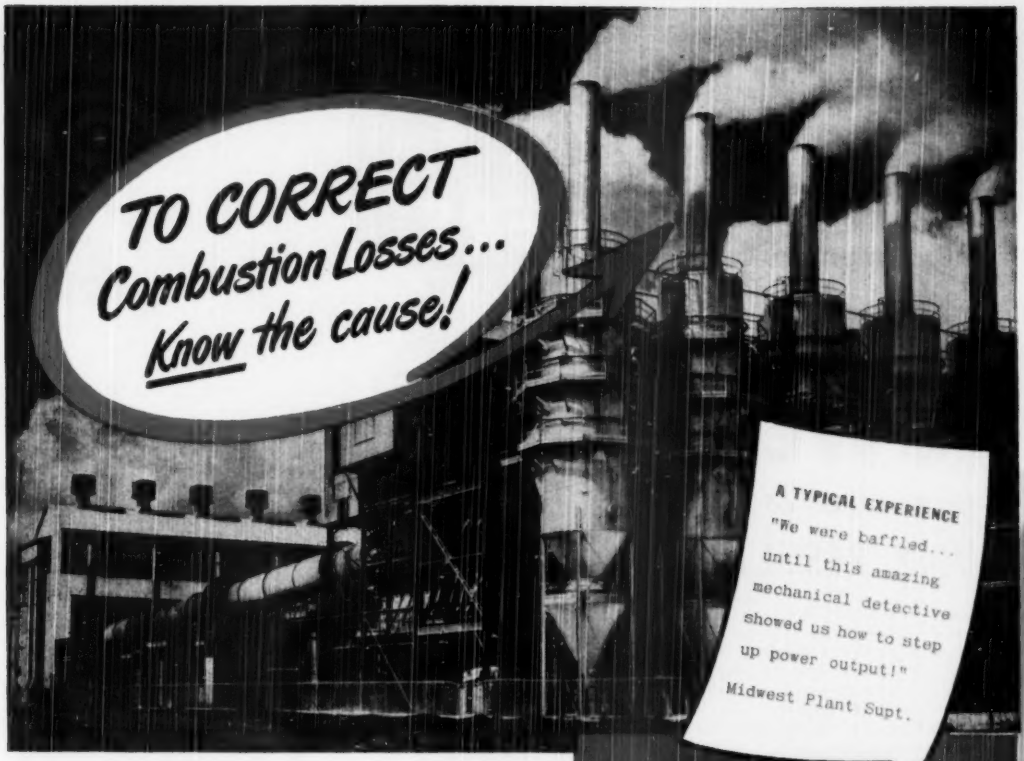
North American Mfg Co, 4455 East 71st St, Cleveland 5, Ohio



REPULSION-INDUCTION MOTOR P967

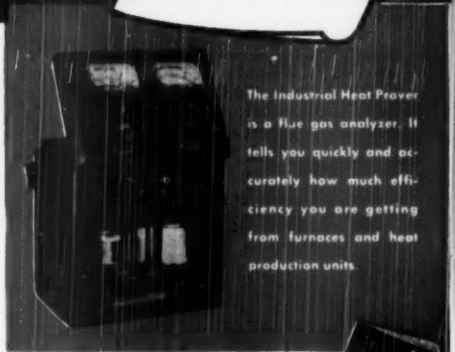
For use where a constant-speed high-torque single-phase motor is needed in large ratings. This recent addition to *Tri-Clad* motor line combines high starting torque of repulsion motor with constant-speed characteristics of induction motor.

Designated as Type *SCR*, motor is available in 5-, 7½- and 10-hp ratings, all at


TO CORRECT
Combustion Losses...
Know the cause!
A TYPICAL EXPERIENCE
"We were baffled... until this amazing mechanical detective showed us how to step up power output!"
Midwest Plant Supt.

Rule-of-thumb methods in tracing causes of fuel waste and power loss have been made obsolete by the Cities Service Industrial Heat Prover. A recent case is typical: Heat was plainly being wasted; production was suffering, and routine "corrections" had failed. Then a Cities Service engineer was called in. As always, a Heat Prover test quickly supplied data on major combustion factors. The evidence pointed to outright heat leakage – confirmed by discovery of cracked brickwork. After repairs the average power output jumped 22%!

Similar contributions to production efficiency are reported often—because the reliability of Heat Prover combustion analysis makes it simpler to determine effective corrections. Ask about this service for your plant.



The Industrial Heat Prover is a flue gas analyzer. It tells you quickly and accurately how much efficiency you are getting from furnaces and heat production units.

FREE – Booklet completely describes the Cities Service Heat Prover. Mail coupon for your copy.

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CITIES SERVICE OIL COMPANY
Sixty Wall Tower, Room 695
New York 5, New York

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*Company*_____

*Address*_____

*City*_____ *State*_____

ROTOJET
Water-driven TUBE CLEANERS

Deliver all the
POWER
you need for
QUICK RESULTS

ROTOJET Water-driven Tube Cleaners provide power heretofore obtainable only with air-driven equipment. A vast increase in power and a material reduction in water consumption were achieved through radical design changes based upon latest research in hydrodynamics.

The new ROTOJET removes the hardest scale much more quickly and efficiently than ever before possible with water-driven equipment. Send for new ROTOJET Bulletin.

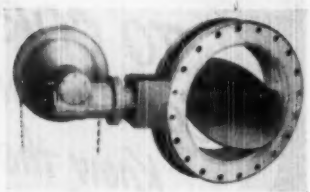
C321 ROTOJET Water-driven Motor with short 4-arm head and universal joint for 2¼" I.D. straight tubes.

ELLIOTT COMPANY-ROTO DIVISION
153 Sussex Avenue **Newark 1, N. J.**

1800 rpm. 5-hp unit operates 115/230 v, while other two use 230 v.

Typical applications include air and refrigeration compressors, pumps, stokers, etc. Motor is of drip-proof type.

General Electric Co, Schenectady 5, N. Y.



RUBBER-LINED VALVE **P976**

Suitable for slurries or dry pulverant materials in air-transport lines, valve No. 737 can be completely lined with hard, soft-natural or synthetic rubber. Lining is sealed to vane and valve body. Rubber on flanges takes the place of usual gaskets.

Manual or automatic controls of all types can be fitted to valve. Sizes from 2 to 72-in. in temperature range from –40 to 275 F.

R-S Products Corp, Wayne Junction, Philadelphia 44, Pa.

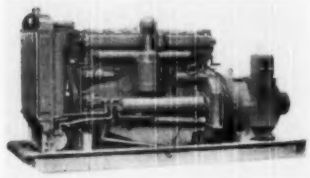
ANNUNCIATOR **P990**

Designed for readability at great distances, type *ANJ* annunciator has 2¾x9¾-in. window areas. Lettering is on heavy photographic negative held between glass sheets.

White lettering against a sharp black background insures readability up to 60 ft. Annunciator is well suited for use in boiler rooms and control rooms where operators are often stationed at opposite end of room from the annunciator.

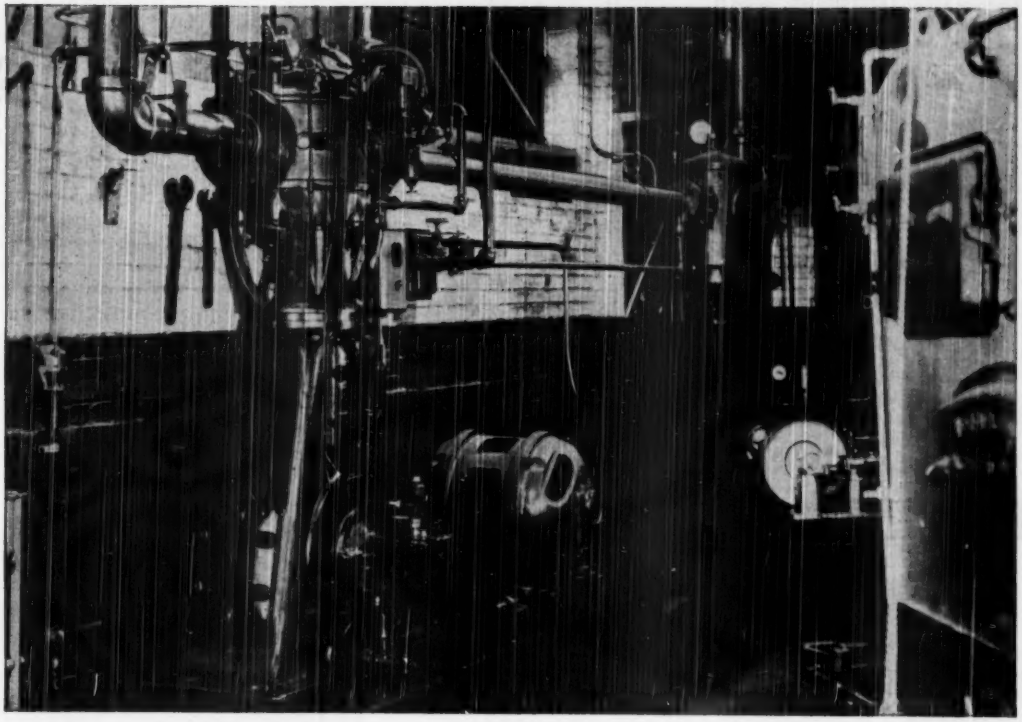
Device is for surface or flush mounting and may be used to supervise liquid levels, circuit breakers, motor starters, temperatures, pressures, etc.

The Autocall Co, Shelby, Ohio.



DIESEL GENERATOR SETS **P971**

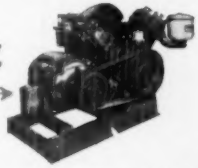
Available in 11 models ranging from 60 to 113-kw, units are heavy-duty type, as-



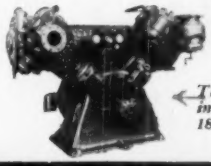
SAVE VALUABLE SPACE WITH THE EFFICIENT

JOY WG-9 HEAVY DUTY AIR COMPRESSOR

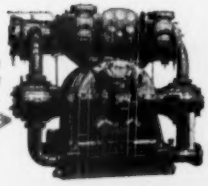
The vertical design and small base of the JOY WG-9 Compressor mean great savings in valuable floor space. Built in seventeen sizes from 108 to 881 CFM, the WG-9 is designed for continuous heavy-duty service . . . features the exclusive JOY "Dual-Cushion" valves for top efficiency and lowest-cost operation. ● JOY builds the most modern compressors available for either centralized or decentralized air supply—*write for Bulletin.*



The JOY WL-80, in eleven sizes from 81 to 640 CFM.



The JOY WN-112, in sizes from 378 to 1828 CFM.



The JOY WN-114, in single or twin units from 1092 to 7312 CFM.

Consult a Joy Engineer

W&D 12049

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

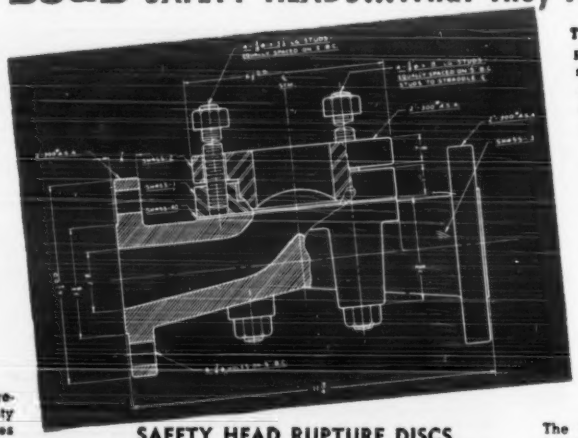
IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

BS&B SAFETY HEADS...What They Are...How You Can Use Them:

This installation is used when it is not necessary to have a shut-off or when materials handled are not toxic or inflammable.

A SAFETY HEAD under your relief valve or BS&B combined safety head-relief valve assembly isolates the valve from the vessel contents. This stops leakage through relief valve until SAFETY HEAD disc is burst by overpressure, as well as protecting valve parts from corrosive, viscous or gummy materials. An open bleed line or some type of telltale indicator must be installed in chamber between rupture disc and valve plug.

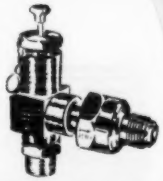
BLACK, SIVALLS & BRYSON, INC.
Special Products Division
KANSAS CITY ● TULSA
OKLAHOMA CITY



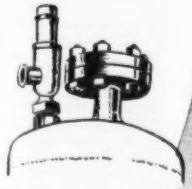
The BS&B SAFETY HEAD consists of three principal parts . . . a pre-formed metal rupture disc and two specially designed holding flanges. Correct element resistant metals are used in fabrication of the rupture disc, which bursts when a pre-determined pressure is reached. Instantly a fully unrestricted escape for gases and liquids takes place. No other relief device acts so quickly as the BS&B SAFETY HEAD.

HOW THE NEW T-ASSEMBLY SAFETY HEAD WORKS

Viscous material washes against the rupture disc as it flows through the curved channel indicated by the shaded portions of the diagram. The material moves on through the passage if no undue pressure rise occurs. However, if the passage becomes blocked, such material will tend to solidify quickly, causing a dangerous pressure rise. In that case, the SAFETY HEAD rupture disc bursts and the pressure is given a fully unrestricted opening.



A SAFETY HEAD at the relief outlet will stop leakage until rupture disc bursting pressure is attained. Not recommended where viscous or corrosive materials might contaminate internal parts of the valve. Investigate your valve design before using this type of installation.



If relief valve, used for primary relief, fails to function due to corrosive, gummy or viscous materials contaminating valve parts, the rupture disc will afford positive protection when pressure rises to disc bursting pressure since a full, unrestricted, pipe size opening is afforded. The Safety Head used as the secondary relief device, would have rupture disc bursting pressure considerably higher than spring setting of valve.

SAFETY HEAD RUPTURE DISCS

The selection of the proper metal for the rupture disc is based upon the conditions of a given application, such as size, pressure, temperature and vessel contents.

BS&B rupture discs are offered in metals listed below.

The following table gives the approximate minimum bursting pressure for a rupture disc of a given material in the various sizes of SAFETY HEADS.

These figures are the practical minimum bursting pressures. In some cases we can furnish rupture discs for pressures below those shown.

MINIMUM BURSTING PRESSURE OF SAFETY HEAD RUPTURE DISC

Diaphragm Material	½"	¾"	1"	1½"	2"	3"	4"	6"	8"	10"	12"	16"	20"	24"
Aluminum	150	130	100	80	50	40	35	25	20	19	18	17	16	15
Aluminum Lead Lined	200	175	135	120	65	50	40	30	20	19	18	17	21	20
Carbon Steel	1750	1200	750	500	300	200	155	115	105	85	65	40	50	62
Copper or Copper Lead Dipped (both sides)	330	225	175	120	65	50	40	25	35	42	55	55	70	60
Inconel	775	525	410	260	150	105	82	61	48	Special				
Monel	570	390	280	190	115	75	65	50	39	33	360	270	215	170
Nickel	600	400	280	195	115	110	100	75	60	47	Special			
Platinum	250	200	140	120	65	45	35	26	Special					
Silver	250	175	125	95	55	40	35	32	27	Special				
Stainless Steel (347)	820	560	435	280	160	115	90	70	55	45	160	120	95	140

Get this Catalog

Technical data compiled especially for the chemical, petroleum, refrigeration and air conditioning industries. Proven protection for expensive equipment. Check, sign and mail coupon to BS&B today.

FREE

Have an analysis made of your equipment by BS&B engineers without cost or obligation. Mail coupon or call Jim Myers, GRand 6700, Kansas City, Mo.

BLACK, SIVALLS & BRYSON, INC.
720 Delaware, Sec. 6-4-9, Kansas City, Mo.

☐ Please send me a copy of the new BS&B SAFETY HEAD catalog.

☐ Please have a BS&B SAFETY HEAD engineer analyze my relief problem, without cost, or obligation to me.

Name_____

Firm_____

Title_____

Address_____

City_____ Zone____ State_____

BS&B SAFETY HEADS

sembled and aligned at factory. Suitable for parallel operation of two or more sets with manual or automatic switches.

Unit fuel injectors, four valves per cylinder and oil-cooled pistons are used. Hydraulic governor maintains desired frequency and voltage at all rated loads. Voltage regulator is included. Mounted on skid, installation can be portable or stationary. Radiator or heat-exchanger cooling. **Murphy Diesel Co, 5317 W Burnham St, Milwaukee 14, Wis.**

RECTIFIER UNITS **P989**

Floor or wall-mounted electronic rectifier units to convert ac to dc for general-purpose industrial and commercial applications. Standard units can be supplied with constant or adjustable dc output voltages, in ratings as high as 230 v, 87 amp.

All components including the anode transformers are mounted in factory-assembled enclosures to simplify installation and to facilitate inspection and maintenance. Units are designed for operation from 115/230 or 230/460 v, single or 3-phase. **Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.**

LAMP-TYPE ANNUNCIATOR **P966**

Device uses 1 x 3 in. engraved *Lamacoid* windows which permit dividing each window into two areas each 1 x 1½ in. A 1 x 1-in. space may be utilized for a red spot to serve as a pilot light when a trouble signal has been acknowledged. **King Products Co, 1110 Euclid Ave, Cleveland, Ohio.**

GEAR SPEED-REDUCER **P910**

Designed for a wide variety of power-transmission needs, these speed reducers are adapted to electric motor, belt, chain

B&B Safety Heads

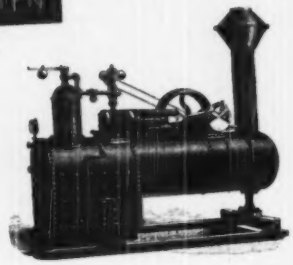
Purposely Designed and Engineered "Weak Spots" For Your Pressure Equipment

They safely handle highly viscous materials in undue pressure rises;

Provide relief venting for a dangerously fast pressure rise;

Afford extra protection for expensive equipment.

THEN



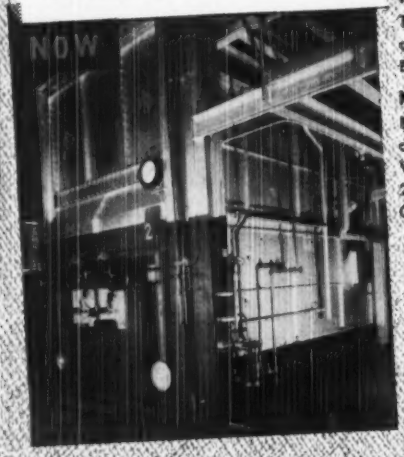
WHAT'S IN BETWEEN THESE BOILERS BY BIGELOW ?

Between the two Bigelow boilers shown stands almost a century of boiler-making experience. During those years, Bigelow's reputation has been written in steam by thousands of successful, efficient and long-lived boiler installations all over the world.

What This Means To You

When you are in the market for a new boiler, you will benefit by what has happened in the time between these two boilers. You will get the advantage of the experience and progress in design, construction and inspection embodied in Boilers By Bigelow.

Write for free catalogs on any of the units listed.



THEN
This coal-fired boiler was one of the earliest Boilers By Bigelow.

NOW
Bigelow boiler installed recently at Waterbury Hospital, Waterbury, Conn. Capacity 23,000 lbs. steam per hour. Oil-fired.

Boilers By Bigelow

Water Tube Boilers — Bent Tube Types
Horizontal Return Tubular Boilers
Scotch Type Boilers
Two-Pass Boilers
Electric Steam Generators

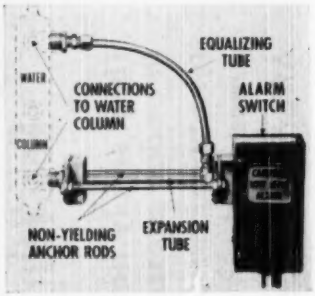
A1-2

THE BIGELOW COMPANY • NEW HAVEN 3, CONN.

BIGELOW REPRESENTATIVES: Boston • New York • Philadelphia • Syracuse • Detroit • Chicago • Pittsburgh • Milwaukee New Orleans • Baltimore • Petersburg, Va. • Washington, D. C. Albuquerque • San Francisco • Seattle • Sumter, S. C.

or gas-engine drives. They can be used either as speed increasers or reducers and are rated according to American Gear Manufacturers' Association standards.

Concentric-shaft speed reducers have an output speed range of 1 to 1170 rpm with input speed up to 1750 rpm. Minimum speed ratio is 1.5 to 1, maximum 970 to 1 and horsepower range 1 to 50. Horizontal or vertical right-angle drives have an output speed range of 1 to 350 rpm with input speeds up to 1750 rpm. Minimum speed ratio is 5.7 to 1 and maximum 515 to 1 with horsepower ratings of 1 to 50 hp. Engineering bulletins 1105 and 2104 available.
The Falk Corp, Milwaukee 8, Wisc.

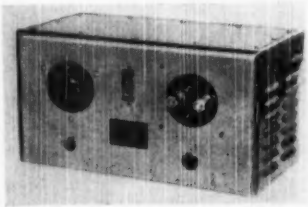


BOILER ALARMS **P927**

In average boiler there is around 100-F difference between boiler saturated steam temperature and water in the water column. This fact is put to work in this company's *Micro-Thermal* low-level boiler-water alarm. A special equalizing tube reacts to temperature changes to set low-level alarm in operation.
J A Campbell Co, 645 E Wardlow Rd, Long Beach 7, Cal.

PLASTIC GEAR **P947**

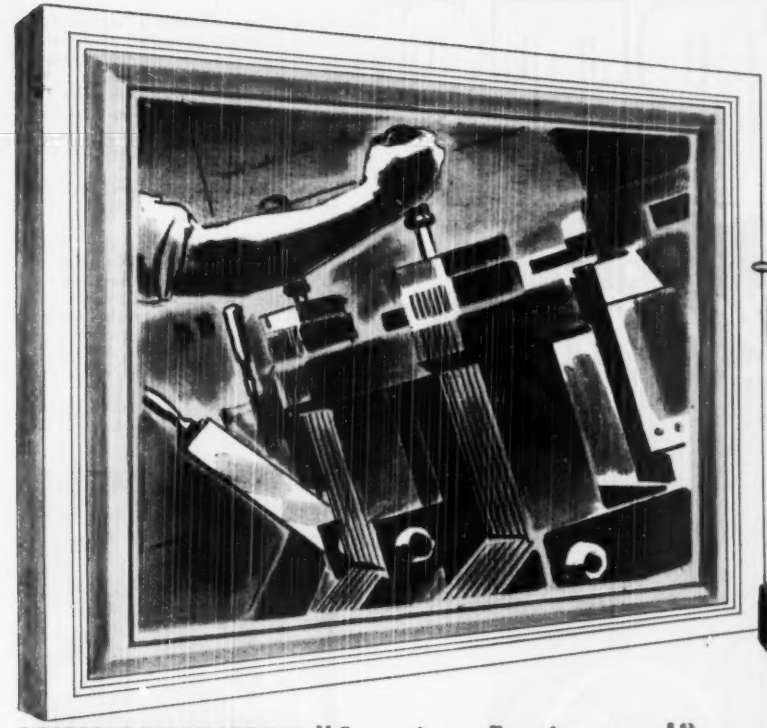
Abrasive- and chemical-resistant high-strength plastic, *Enrup*, promises to become one of basic raw materials of rubber industry, states its maker. Gears made of new plastic have outlasted conventional metal gears in many applications. Right now the fields of heavy-duty lathes, household appliances, dynamometers have proved most receptive.
United States Rubber Co, Rockefeller Center, New York 20, N. Y.

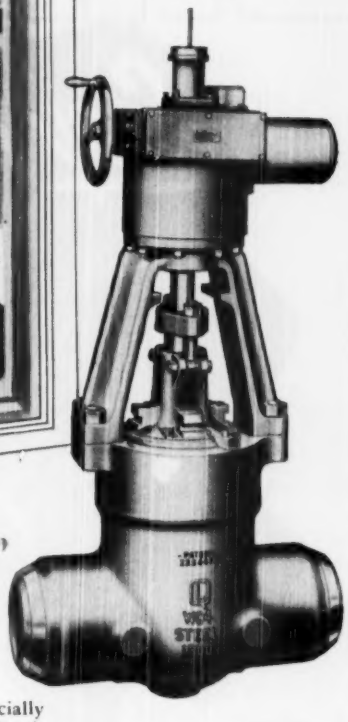


HIGH-CURRENT TESTER **P965**

Multi-Amp tests overload relays for any ac motor whose load running current is 250 amp or less. With larger motors having current transformers the test can be made on the secondary side of the ct.

Exact current needed is available by





LUNKENHEIMER "Service-Engineered" Steel Valves Will Meet YOUR SPECIFIC APPLICATION PROBLEMS

MAINTENANCE costs need specialized attention, these days—especially in the power field, where steel valves are vitally important. There's no cure-all for your valve maintenance problem. It has to be tackled an installation at a time — service by service — and that's where Lunkenheimer engineering comes in.

Lunkenheimer breech-lock valves are your insurance against excessive valve maintenance. Gaskets, rings, flanges, and bolting, all of which tend to induce leakage because of their instability at high pressures and temperatures, have been eliminated. Bodies and bonnets are locked securely together by intermeshing lugs that carry the full internal pressure. Maintenance of the joint is never required, and pressure tightness is unaffected by high pressures, high temperatures, sudden quenches, or creep. It's simplicity itself — an exclusive, patented design, developed by Lunkenheimer to eliminate any possibility of bonnet-joint leakage. Call in the Lunkenheimer representative in your area. He'll be glad to put at your command all the generations of successful experience behind Lunkenheimer's complete selection of "service-engineered" steel valves. For his address, write The Lunkenheimer Co., P. O. Box 360A, Cincinnati 14, Ohio.

STEEL • • • IRON • • • BRONZE

LUNKENHEIMER

THE ONE *Great* NAME IN VALVES

DARTS

Stay Tight

This True Ball Joint Makes the Difference

Careful Special Grinding of the seats ensures that every Dart has a joint with true-bearing surfaces. The reason you always get a snug fit and a drop-tight joint with Darts.

Bronze to Bronze. To ensure permanency . . . longer service, *both* seats are made of non-corroding bronze.

Body and Nut are made of high-test, air-refined malleable iron... practically indestructible. Another one of the reasons why you get longer, better service from Darts.

Always specify Dart when you want a union you can depend on.

E. M. DART MFG. CO.
Providence 5, Rhode Island

DART UNIONS

adjusting knob on front of cabinet. Current is adjustable throughout entire range in stepless increments. Continuous rating of this device is set at 500 amp.

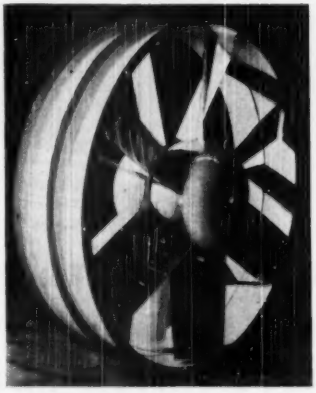
Unit ties into 110-v, 60-cycle outlet. Device can also be used for drying out motors and electric windings, thawing pipes, soldering, brazing, etc. Unit sells for $195 fob Harrison, N. J.

Custom Electric Controller Co, Cross St, Harrison, N. J.

FULL-FLOW VALVE **P984**

Full-throttling, full-flow globe valve has high disk lift and large flow areas above and below seats. Turbulence and pressure drop through valve are low. Renewable, regrindable cone-shaped seats and disks are stainless steel hardened to about 500 Brinell. Valves available with screwed ends in sizes from ⅛ to 3-in.

The Wm. Powell Co, 2503-31 Spring Grove Ave, Cincinnati 22, Ohio



VENTILATING FAN **P935**

Rugged, direct-drive Series 16 ventilating fan from 3 to 5 ft in diameter and capacities from 11,000 to 30,000 cfm. Its motor is completely enclosed within hub and housing. Motor has oversized, permanently sealed silicone-lubricated ball bearings.

The Moore Co, 800 South Missouri, Marceline, Mo.

UNIT HEATER **P937**

Single, large unit heater, the *Thermobloc* Model 1000, delivers 1,000,000 Btu per hr. It occupies a floor area 44 by 70 in. and is 9 ft 7 in. high. Lowered outlets at top of unit provide an even 360-deg distribution of low velocity, heated air.

Prat-Daniel Corp, East Port Chester, Conn.

SPECIALTY PAINT **P967**

White, *Odor-Less* paint, resistant to gasoline, carbon tetrachloride and lime in plaster. It can be brushed or sprayed on damp or dry surfaces without tainting food by giving off a paint odor.

Wilbur & Williams Co, Greenleaf and Leon St., Boston 15, Mass.

PIPING STAPLE **P938**

Pure copper *Tube-Tite* staples made with steel cores, come in three sizes designed

HERCULES COULD GET AWAY WITH IT!

AUGEUS, king of Elis, according to Greek legend, kept 3,000 oxen, and—when Hercules was assigned to the job—their stables hadn't been cleaned in thirty years. The resourceful "strong man" turned the river Alpheus through the stables and cleaned them up in one day.

Hercules could get away with it because he had an unlimited supply of cheap water, and no worries about stream pollution.

Modern industry is less fortunate. Water is not unlimited, and it is becoming increasingly expensive, even when you merely want to throw it away. Today, disposal of waste water requires consideration from many viewpoints. What will you be allowed to discharge into a stream which is a source of water for others? What values can you recover from your waste? More and more, industry is coming to look on its water as an essential and valuable engineering material to be conserved, recovered and reused.

Hall engineers analyze your water problems from that point of view. The procedures which they recommend for the most efficient use of water are technically sound, practical, specific and economical. Waste disposal methods are included in these recommendations—but in many instances more efficient water use may almost eliminate the disposal problem.

If you are concerned in any way with industrial water problems, you will be interested in two new Hall bulletins. "Your Most Important Raw Material" deals with industrial water problems in general and "Let's Consider Your *Whole* Water Problem" discusses the relation of water use to problems of waste disposal. May we send you copies of either or both? Hall Laboratories, Inc., Hagan Building, Pittsburgh 30, Pa.

HALL *plant-wide* WATER SERVICE

BOILER WATER CONDITIONING

PROCUREMENT, TREATMENT, USAGE AND DISPOSAL OF INDUSTRIAL WATER

How to meet a payroll (at a cost of $3.19)

Twenty-four hours before factory payday, another check-writing machine was needed *fast*. At 10 A.M. plant manager ordered one from supplier 400 miles away. He specified Air Express, the service regularly used to keep production rolling. 26-lb. carton delivered same day at 2 P.M.—in time! Shipping cost only **$3.19!**

$3.19 was total cost—and *included* door-to-door service! Air Express is the most convenient way for you to ship or receive—in addition to being the world's fastest transportation method.

You get round-the-clock service with Air Express. Shipments go on all flights of the Scheduled Airlines. Air Express is service you can *count on* to keep your business rolling in high gear.

Air Express gives you all these advantages

World's fastest transportation method.
Special door-to-door service at no extra cost.
One-carrier responsibility all the way.
1150 cities served direct by air; air-rail to 18,000 off-airline offices.
Experienced Air Express has handled over 25 million shipments.

Because of these advantages, regular use of Air Express pays. It's your best air shipping buy. For fastest shipping action, phone Air Express Division, Railway Express Agency. (Many low commodity rates in effect. Investigate.)

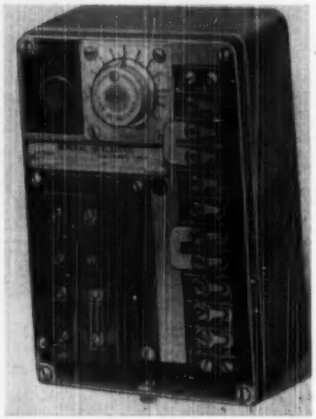
Rates include pick-up and delivery door to door in all principal towns and cities

A service of
Railway Express Agency and the
SCHEDULED AIRLINES of the U.S.

to fit ⅜, ½, or ¾ in. nominal tubing. For the first two sizes a flat staple top has been designed and a round wire one for the ¾ in. size. These staples answer the need for a quick, easy-to-install fastener for radiant heating, hot or cold service lines, refrigeration tubing.
E H Titchener & Co, Binghamton, N.Y.

MASONRY DRILL **P939**

Piano wire wound in a low helix around the steel shank of a carbide-tipped *Live-Spiral* masonry drill forms a flute that removes the dust as fast as it forms. No dust packs in the holes and the drill need not be withdrawn as drilling progresses.
Carboloy Co, 11155 E. Mile Drive, Detroit 32, Mich.



ELECTRONIC TIMER **P998**

Designed for automatic control of operation, limit, and sequence timing for many industrial processes. Device is available in three time ranges: 0.06-1.2 seconds, 0.6-12 seconds and 6-120 seconds.

Timer features a detachable back plate which mounts directly on rigid conduit or any flat surface. Mechanical wear is cut to a minimum with electronic device since relay armature is only moving part. Type 6J5 in timer is standard model readily available at most radio stores. Device will handle inrush current of 15 amp, carry 10 amp and break 5 amp.
General Electric Co, Schenectady 5, N. Y.

FLEXIBLE COUPLING **P905**

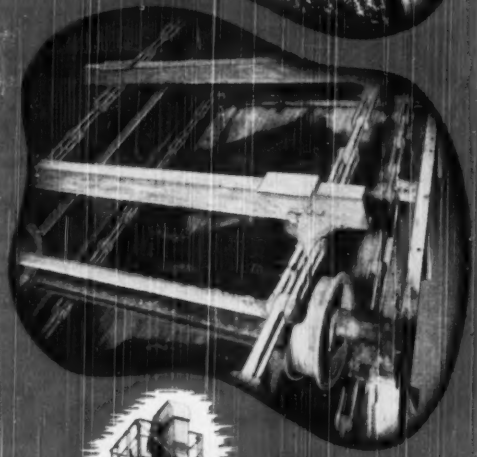
Concave-jaw surface of this coupling holds resilient synthetic-rubber insert or spider in position, eliminating tendency of rubber to extrude or break. Available for ½- to 1⅝-in. shafts and fractional to 25-hp capacity.
Gerbing Mfg Corp, Roto Cone Variable Pulley Div, Northbrook, Ill.

MIDGET PUMPING UNIT **P907**

Available in either 5-pt or 3-gal capacity with a reservoir mounted on an open, totally enclosed, or explosion-proof motor. Pump, check valve and relief valve are in the reservoir. Reservoirs are made of alumi-

WILMOT HAS

Everything FOR COAL, SLUDGE, ASH CONVEYORS



For over 40 years Wilmot has been specializing in designing and building conveyors and elevators for mines, public utilities and other large handlers of fuel and ash. We not only offer you a wealth of engineering and installation know-how, but we also manufacture and maintain a complete stock of all needed parts: C. I. or steel flights, sprockets, traction wheels, take-ups, shafting, bearings, casings, trough, etc.

Wilmot Stocks Largest Choice of Chain Sizes, Attachments

As the originators of "Rivetless" chain, Wilmot manufactures the largest choice of chain sizes available: in pitches from 3" to 10½", and working loads from 3,000 to 130,000 lbs.; of drop-forged EEE alloy steel, normalized or heat-treated; or alloy steels 3140 and 3240. Wilmot also stocks the largest selection of chain attachments for coal, sludge and ash conveyors. Send for our 280-page chain and conveyor catalog and see why hundreds of plants are now solving their design and delivery problems by placing single responsibility on Wilmot for supplying all their replacement needs.

Full engineering data for designers or maintainers of conveyors and elevators.

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Conveyors, Elevators

WILMOT ENGINEERING CO.
HAZLETON, PA.
Plant: WHITE HAVEN, PA.

Stop Losing Money

in Pressure Reducing . . .

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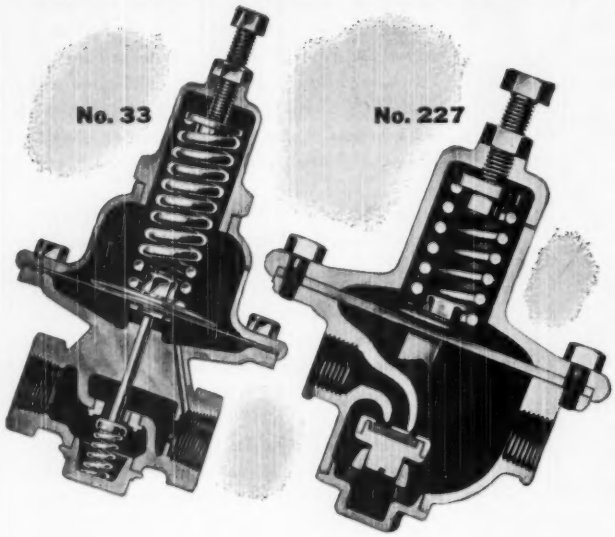
MASONEILAN

PRESSURE REGULATORS



Masoneilan Reducing valves make a hit with production and maintenance men in all types of industries because they furnish economical pressure control. Their dependable operation, low maintenance cost and minimum time-out-of-service saves money through accurate control and reduced waste.

No. 33 for steam and air service — Sizes from ⅛″ to ¾″. Reduced pressure ranges 2-20; 20-40; 40-100 psi. Maximum working pressure 200 lbs.

No. 227 for water service — Sizes ¼″ to 2″. Reduced pressure ranges 10 to 60 psi. Maximum working pressure 150 psi. Also available for air service from ¼″ to 1″.

Your local Masoneilan industrial distributor is ready to serve you from stock; or write

MASON-NEILAN REGULATOR CO.

1186 ADAMS STREET, BOSTON 24, MASS., U. S. A.

Sales Offices or Distributors in the Following Cities:

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Detroit • Los Angeles • El Paso
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Charlotte, N. C.

Mason-Neilan Regulator Co., Ltd., Montreal and Toronto

num; open-motor units have aluminum motor frames. Pressure and return-line connections are ⅜-in. OD flared tubing or ¼-in. threaded hose-coupling connections. Pump pressure set at factory as specified by customer.

John Dusenbery Co, 271 Grove St, Verona, N.J.

VERTICAL TURBINE PUMPS P908

Line of new models allows selection of a pump for nearly any capacity and head conditions from 50 to 15,000 gpm. Pumps have extra-size bearings, shaft seals, enclosed impellers, wearing rings, flanged and bolted bowls. They are either oil or water lubricated and can be driven by motor, right-angle gear or belt. Unit can be installed in wells for irrigation, industrial and municipal water supply and for pumping refinery products or other liquids. Descriptive bulletins with specifications are available.

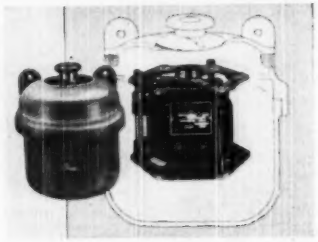
Worthington Pump & Machinery Corp, Harrison, N.J.

COOLANT PUMP P909

Impeller housing, spacer supports, mounting flange and lower motor end bell are one casting in this coolant pump. One of the spacer supports is cored for a discharge passage from pump through plate flange. This simplifies mounting in a tank in machine bed plates, by eliminating piping in reservoir.

Driving motor has permanently lubricated ball bearings. One-piece shaft extends full length of unit, through motor rotor and pump impeller.

The Ruthman Machinery Co, Cincinnati 2, Ohio



VARIABLE TRANSFORMER P964

Explosion-proof *Powerstat* provides safe means for getting a continuously adjustable source of ac voltage in hazardous areas where small arc or spark could cause explosion. Devices carry Underwriters' approval for Class 1, Group D service. Units are available for 115- and 230-v ratings for single-phase operation.

The Superior Electric Co, Hannon Ave, Bristol, Conn.

CRANKCASE-OIL TESTER P987

Model 75 test set measures light transmission through a thin layer of crankcase oil. This measurement is an indication of the degree of contamination by carbon, metal and other particles. It is intended for use with gasoline and diesel engines of automotive and stationary types.

Charts indicate when oil should be

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1 Better heat transfer

Enco's improved baffle design insures a uniform, high velocity gas flow over every square foot of heating surface.

2 Low draft loss

Smoothly curved baffles maintain a cross-flow of gases across the tube banks. Dead gas areas, bottlenecks and eddy currents are eliminated.

3 Less steam, less time for cleaning

Soot doesn't get a chance to accumulate in pockets. Soot blowers are used less often. Streamlined baffles lower maintenance costs.

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Experienced Enco crews take charge of the installation, repairs and replacements of your individually designed streamlined baffles—do the job thoroughly and quickly with minimum downtime.

BULLETIN BW44 tells the full story, contains complete engineering data, explains how Enco Baffles provide maximum steam output with minimum fuel consumption. WRITE FOR YOUR FREE COPY TODAY!

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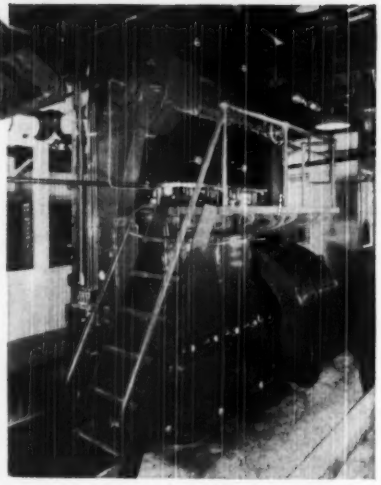
Since 1913

SKINNER
ENGINE-GENERATOR UNITS

have supplied the electric power at Eastern Tanners Glue Division of Peter Cooper Corporations



A repeat order is the best evidence of satisfaction, and the Eastern Tanners Glue Division of Peter Cooper Corporations, Gowanda, N. Y. furnishes additional testimony to that fact.

In 1913, two 200-kw. Skinner Engine-Generator units were installed in this plant. By 1924, three additional units were added. Recently a two-cylinder Skinner Vertical "Universal Unaflow" Steam Engine, directly connected to a 400-kw. D.C. generator, was installed. All six engines are still in operation and have a total capacity of 1500 kw.

Eastern Tanners Glue, like many others who have enlarged their plant capacity, have found it more economical to install additional Skinner "Universal Unaflow" Steam Engines to meet their increased power requirements.

Our engineers will make accurate estimates to prove you can produce dependable power at a fraction of the cost of purchased power. Write for detailed information of the advantages of Skinner "Universal Unaflow" Engines in your field.

For Over 80 Years, Doing One Thing Well—Building Steam Engines

SKINNER ENGINE COMPANY, ERIE, PA.

changed and how effective oil filter is. Measurement is based on action of light upon a self-generating photocell of dry-disk type. Set can be connected either to the ac power line or to an automobile battery.
Photovolt Corp, 95 Madison Ave, New York 16, N. Y.

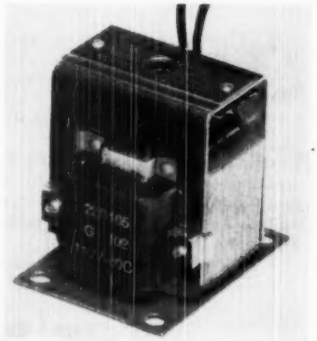
CRO PATTERN TRACER **P997**

An optical super-positioning device that allows tracing of cathode-ray patterns directly on graph paper. Use of the *Oscillo-Tracer* for viewing oscillograms increases accuracy by eliminating parallax caused by curved-face cathode-ray tubes and flat calibrated scales.

The projected pattern is exactly the size of the original trace. Device is sold direct to users at $19.50 fob Waltham, Mass.
Robert A. Waters, Inc, 4 Gordon St, Waltham 54, Mass.

ARC WELDER **P931**

Construction kit, designed from production models at the manufacturer's plant, enables buyer to build his own arc welder. Kit consists of transformer coils, ready-made and tested, transformer sheet, die cut to size, and other parts requiring only assembly into a heavy-duty arc welder.
Atomic Arc Welder Co, 3302 Dodge St, Omaha 3, Nebraska.



LONG-LIFE SOLENOID **P995**

Basic component is a paper-layer-wound coil that holds voltage between turns to a minimum and greatly reduces possibility of

SLUDGE OR SCALE?

There's no place for guesswork in boiler rooms. Scale and adherent sludge cause tube metal to overheat and fail. They often look alike—yet the cause and cure of each may be entirely different. Someone *has* to know this difference or your water treatment may fail.

*Sludge,** a water-formed sedimentary deposit, may include all suspended solids in the water. "Baked-on" sludge is hard and adherent, similar to scale.

*Scale** usually forms from solution directly in place on the surface. It is crystalline and dense in nature.

The Drew System of Water Treatment eliminates guesswork! It starts with proper diagnosis. Corrective treatment, modification of operating cycles, redesign of equipment and other preventive measures are recommended when required. The Drew System is more than superficial service . . . more than chemical "prescriptions" . . . it is specialized service, corrective treatment and preventive measures applied to your individual boiler problem.

*Brief ASTM definition. Send for additional information on the cause and cure of sludge, scale or other water problems.

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Power Chemicals Division

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DREW PRODUCTS

Nationwide service in Boiler Water and Cooling Water Conditioning

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BETTER MECHANICS PREFER
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THREADER
FOR 1" to 2" PIPE
because
It's ACCURATE!
Perfect threads produced by separate Toledo Dies for each pipe size.
It's EASY THREADING!
Less friction due to famous Toledo receding die principle — small die segments with only a few cutting teeth backed by taper pins.
It's LOW COST!
Simple in design with one ratchet handle.

Do your next 1" to 2" pipe work with a Toledo 1R Threader—the tool that's "tops" with better mechanics! Similar to the famous No. 1 and No. 1A Toledos—but *simpler in design* with one ratchet handle and *low in cost!* A separate set of dies for each size of pipe —1", 1¼", 1½" and 2"—assures longer die life. Each set is hobbed for just the proper clearance. This means easier cutting, smoother, cleaner, more perfect threads and tighter pipe joints! Die change is quick and easy . . . or, many users prefer separate tool for each size. Durable . . . saves job-time . . . reduces costs! Ask your distributor for details and price . . . or send coupon.

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Toledo, Ohio

Without obligation, send bulletin No. 650 and price on Toledo No. 1R Threaders, 1" to 2" pipe.

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Firm.....

Street.....

City.....State.....

failure. After liquid *Permafil* is poured around coil the assembly is baked. Resulting solid protective block around the coil is moisture-, oil-, shock-, and vibration-resistant.

This solenoid is suited for any heavy-duty industrial application calling for a solenoid with a maximum stroke not greater than 5/16 in. It is available in four models including strokes of ⅛ in. and 5/16 in. and two stacking thicknesses.

General Electric Co, Schenectady 5, N. Y.

PROPORTIONING VALVE P985

Using a slide which moves across a rectangular opening this control valve is suitable for equipment and pipes which need straight-line flow characteristics with minimum pressure drop and turbulence. Flow is directly proportional to area open in valve. Opening can be designed to conform to any geometric figure.

Body can be cast iron, cast steel, stainless steel or bronze. Internal working parts are stainless steel. Built in ¼ to 2-in. sizes, pressures to 300 psi. Manual or automatic control can be used.

W S Rockwell Co, 200 Eliot St, Fairfield, Conn.

PORTABLE LIGHT P994

All-purpose, general-utility light that's waterproof, UL-approved and suitable for floodlighting, spotlighting and protective building and yard lighting. Unit is made of non-corrosive, non-rusting cast aluminum throughout. Device comes completely wired with 10 ft of SJT weatherproof cord and molded-rubber plug.

Stone Mfg Co, 489 Henry St, Elizabeth, N. J.

REPLACEABLE FILTER P920

Continuous strands of glass filaments held together by a high temperature plastic bond and made up in the form of a resilient pad features the company's new replaceable air filter, the *Amer-glas*. It is made in all standard sizes, sprayed with odorless and non-flammable adhesive and placed in a fibreboard casing between metal grilles.

American Air Filter Co, 1st St and Central Ave, Louisville 8, Ky.

FLUID METERING P921

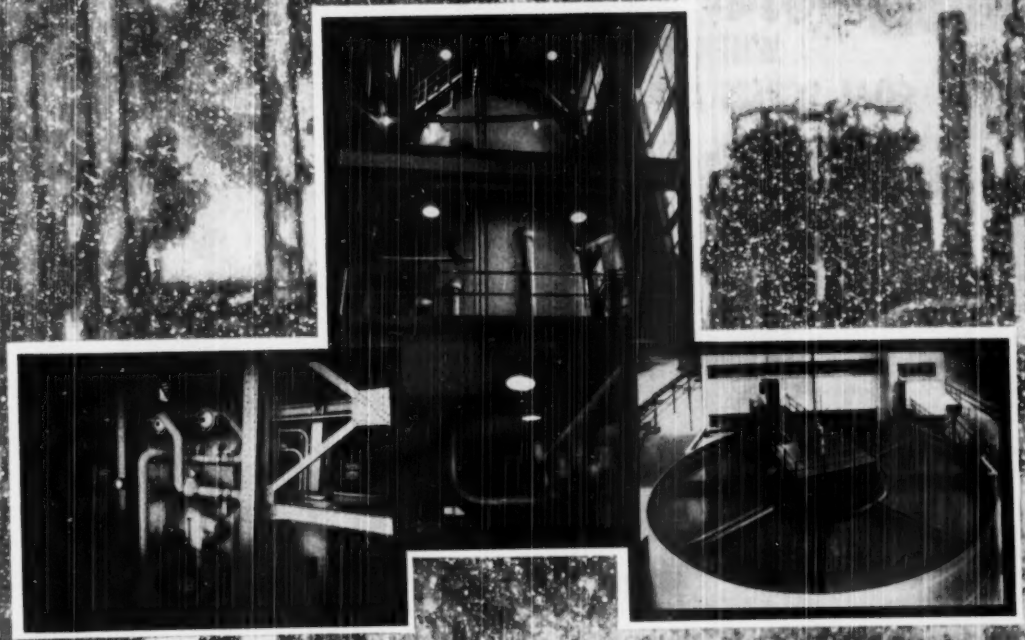
Differential pressure producer consists of a flow tube having a short spool piece with an inner sleeve that is equipped with two groups of pressure nozzles. One set points upstream, the other downstream.

With the flow tube, differential produced is always a power of velocity and

COCHRANE

COCHRANE CORPORATION 87 YEARS OF SERVICE 1863 - 1950

PIONEER AND LEADER IN METHODS AND APPARATUS FOR COMPLETE CONDITIONING OF BOILER FEED, PROCESS AND INDUSTRIAL WATER SUPPLIES



COCHRANE CORPORATION

PHILADELPHIA 32, PA.

In Canada: Canadian General Electric Co., Ltd., Toronto

In Mexico: Babcock & Wilcox de Mexico, S. A., Mexico City

In France: Manufacture Française Thermique & Economique, Paris

In these high times you want full value from every Btu in every pound of coal you buy. It's costly to guess!

Richardson Coal-weighing, Conveying and Feeding Systems provide you with a sure, constant check on the operating efficiency of boilers. Only by weighing and recording every pound of coal burned by each boiler can you spot and rectify inefficiencies in those units which aren't giving you full value. By comparing evaporation rates or kwh. produced with weight of coal consumed, dollar losses can be stopped at the source.

Richardson systems are engineered with stationary, portable or elongated conveyor-scale combinations and are adaptable to all plants and central stations for either pulverizer or stoker-fired furnaces.

Put *every* Btu to work! Keep your records straight, by weight, *all* the time, with one of the many types of Richardson systems. For more details call your nearest Richardson office or write for Bulletin No. 1143.

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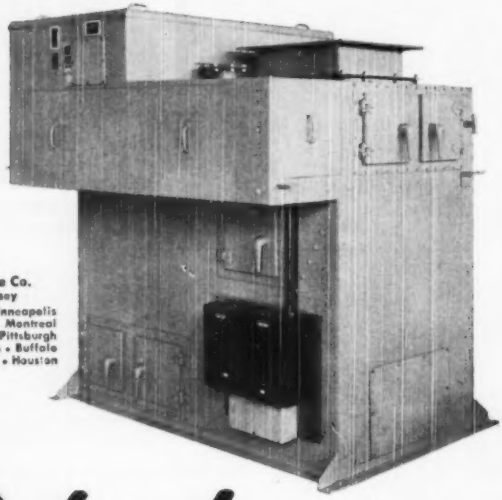
WHEN RICHARDSON COAL SCALES MOVE IN!



Richardson Scale Co.
Clifton, New Jersey
Atlanta • Boston • Minneapolis
Cincinnati • Wichita • Montreal
Omaha • New York • Pittsburgh
San Francisco • Toronto • Buffalo
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Richardson

MATERIALS HANDLING BY WEIGHT

6372

therefore can always accurately measure flow when used with properly calibrated conventional recording, indicating, integrating or control instruments.
Foster Engineering Co, Union, N. J.

CONVEYOR BELTS **P906**

Conveyor belt designed for light-oil service handles grain, oil-treated coal and other materials with light oil content. Another belt handles low-viscosity oils, plasticizers and other materials where oil content is greater and heat may be present.
B F Goodrich Co, Akron, O.

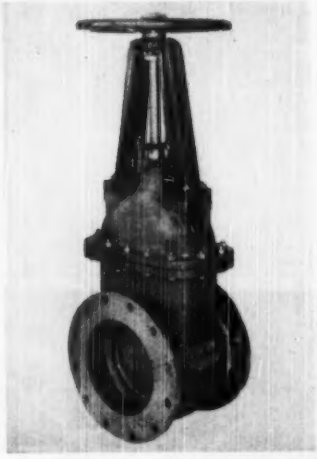
CUTTING ELECTRODE **P936**

All-purpose cutting electrode cuts, pierces, gouges, chamfers or removes welds without using oxygen or special equipment. A high-heat-resistant coating permits concentrating arc at tip so fast cutting becomes possible.
All-State Welding Alloys, Inc, 273 Ferris Ave, White Plains, N. Y.

SUPERCHARGERS **P973**

Designed specifically for Cooper-Bessemer type *LS* and *LSV* engines, these superchargers are suitable for any gas or diesel engine from 1200 to 2500-hp. They are the largest engine superchargers produced here.

Units are suitable for engines in locomotive, marine, pipeline and power-generating services.
Cooper-Bessemer Corp, Mt Vernon, Ohio



GATE VALVE **P977**

Designed for use in refining, chemical processing, pulp and paper mills, corrosion-resistant gate valve is available in type 302, 304, 316 stainless steel and *Pioneer* metal. Heat-treated, valve is all-alloy except handwheel and bushing. Complete range of sizes from ½ to 12 in.

Valve conforms to MSS and ASA standards. *Teflon* packing in ring form is used. Packing is suitable for all materials except molten alkali metals.
The Pioneer Alloy Products Co, Inc, 16621 Euclid Ave, Cleveland 12, Ohio

PLANT EQUIPMENT NEWS

Reader Service Page for New Products and Literature

Use the handy FREE service cards for additional information on this month's new products or for copies of latest trade catalogs.

BOILERS AND AUXILIARIES

B5 **SPREADER STOKER** — Bulletin No. 820 describes spreader stoker with overthrow Rotor that provides uniform fuel distribution. Stationary, hand dumping or power dumping grates. Detroit Stoker Co, Detroit, Mich.

B6 **CENTRIFUGAL BLOWERS** — 12-page booklet No. K-100 gives informative data on McKee centrifugal pressure blowers. Types of construction and applications are illustrated. Velocity pressure table is also given. Eclipse Fuel Engrg Co, Rockford, Ill.

B7 **STEAM GENERATORS**—4-page folder No. 87-1-50-2500 features C300 steam generators for light oil, heavy oil, gas and combination oil and gas operation. Assembly and foundation plan is included. Cyclotherm Corp, 157 E First St, Oswego, N. Y.

B8 **SPREADER STOKERS**—Publication No. 85 contains several illustrations of Chicago Automatic unit drive spreader stokers. A cut-away view shows operating features. Standard Stoker Co, Erie, Pa.

B9 **PROPORTIONING OIL BURNER** —8-page bulletin No. 501 consists of dimensions, capacity tables, shutter and support data plus typical layouts and installations on the Type BI proportioning oil burner. Anthony Co, Long Island City 1, N. Y.

B10 **SPREADER STOKER** — Folder No. 8030 describes an improved type of spreader, having a forward moving grate that slowly and continuously discharges the ash at the front. Detroit Stoker Co, Detroit, Mich.

CONTROLS, MECHANICAL

E1 **PRESSURE REGULATION** — 4-page technical bulletin No. 105 defines the basic differences between flowing service and dead end regulation. Also presents suggested tests, capacity charts, etc. Conoflow Corp, 2100 Arch St, Philadelphia 3, Pa.

E2 **LIQUID LEVEL CONTROL** — 4-page folder No. 1200 discusses Autocon Mototrols, pressure operated pump controls, with twin bellows for elevated tank systems. Construction features and applications are listed. Automatic Control Co, 1005 University Ave, St. Paul 4, Minn.

ELECTRICAL EQUIPMENT

F15 **TRANSFORMERS, REACTORS AND FILTERS**—28-page catalog No. 500 contains complete listing of UTC's line of transformers, reactors and filters. It includes descriptions, applications, specs, amplifier circuits, curves and charts. United Transformer Co, 150 Varick St, New York 13, N. Y.

F16 **VIBRATOR CONVERTERS** — 32-page booklet No. 410 gives comprehensive and detailed information on the company's line of Powercon vibrator converters. 22 models in five different types are covered—ac and dc converters, battery chargers and eliminators, dc to dc converters, etc. Cornell-Dubilier Electric Corp, South Plainfield, N. J.

F17 **DC MOTORS**—12-page bulletin No. C-2001 presents design, construction, selection, and ordering information together with frame dimensions, for Type T heavy duty, constant and

HOW TO ORDER ADDITIONAL DATA

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Your Name.....

Your Title.....

POWER, 330 West 42nd St., New York 18, N. Y. 9/50

adjustable speed dc motors. Reliance Electric & Engrg Co, 1088 Ivanhoe Rd, Cleveland 10, Ohio.

F18 **VARIABLE TRANSFORMER**—4-page folder No. 1503 describes newly redesigned Powerstat variable transformer Types 116 and 216. New mechanical and electrical improvements are all within the old mounting dimensions. Superior Electric Co, Hannon Ave, Bristol, Conn.

HEAT EXCHANGERS

G1 **WATER HEATER**—4-page folder No. WH-13 points out the features of the compact Pick instantaneous steam injection heater. Also shows a simple cost-check table which promotes comparison between various heating methods. Pick Mfg Co, Heater Div, West Bend, Wis.

G2 **EVAPORATORS**—4-page bulletin No. 40A tells about Paracoil evaporators and their conversion to modern low pressure vacuum type distillation plants. Photographs, cycle diagrams of single and double effect plants, and performance data are included. Davis Engrg Corp, 1044 E Grand St, Elizabeth, N. J.

MAINTENANCE AND SAFETY EQUIPMENT

K5 **OIL TESTING EQUIPMENT** — 2 publications are offered. Circular No. 70 illustrates the Gerin kit for acidity tests and gives list price. Bulletin No. 300 features the oil inspection kit which provides test for asphalt and other gummy materials; dirt, scuff metal, other sediment and water; acidity; and for fuel dilution and viscosity. Gerin Corp, Red Bank, N. J.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ **TOOL MAINTENANCE** — 20-page booklet, entitled "Care of Drills and Reamers," shows how greater life can be obtained from cutting tools. Recommendations also cover the field of tungsten carbide tools, in addition to those made from high speed steels, etc. Chicago-Latrobe, 411 W Ontario St, Chicago 10, Ill.

K6 **FUEL OIL TREATMENT**—Folder outlines benefits, economy and money-saving attributes of instant-acting Sabanol, the homogenising fuel oil treatment which is non-toxic and non-explosive. American Sand-Banum Co, 9 Rockefeller Plaza, New York 20, N. Y.

K7 **CONCRETE FLOOR REPAIR** — 8-page bulletin No. MQ-1 illustrates application of Masterquick, an iron asphalt patching material which makes possible easy, fast patching or resurfacing of worn concrete floors. Master Builders Co, Cleveland 3, Ohio.

MAINTENANCE MATERIALS

L12 **CORROSION-RESISTANT PAINT** —12-page catalog No. 712 tells where and how to use Tygon corrosion-resistant paint, and where not to use it. Chemical resistance characteristics, as well as recommended primers and surface treatments are listed. U. S. Stoneware Co, P O Box 350, Akron 9, Ohio.

L13 **HOSE COUPLINGS** — 6-page brochure No. 7 contains sizes and thread data on the new Le-Hi line of fire hose expansion ring couplings and fire hose coupling accessories. Hose Accessories Co, 17th St & Lehigh Ave, Philadelphia 32, Pa.

L14 **CORROSION-RESISTING CEMENTS** — Form No. C-8 describes the use of corrosion-resisting cements to repair cracked corroded and broken pipe, pumps, valves and other mechanical equipment in corrosive service. Carboline Co, 7603 Forsyth Blvd, St. Louis 5, Mo.

L15 **ANTI-RUST PAINT** — 6-page leaflet No. P&P 1002-B lists complete instructions for use of Rustrem anti-rust paint which can be applied right over rust without wire brushing, scraping or sand-blasting. Speco Inc, 7308 Associate Ave, Cleveland 9, Ohio.

L16 **HOSE COUPLINGS AND FITTINGS**—12-page catalog section No. 3100 pictures and gives details on various types of hose couplings and fittings, together with specifications, general and maximum pressure recommendations, etc. B F Goodrich Co, Akron, Ohio.

L17 **FASTENING DEVICES** — 2 forms—No. TB-450 and No. LA-450 illustrate toggle bolts, machine screw lead anchors, and expansion bolts which are available in 66 sizes to meet all popular anchoring needs in floors, walls and ceilings. Holub Industries Inc, 413 DeKalb Ave, Sycamore, Ill.

L18 **RUST PREVENTION** — Catalog covers solution to many rust problems. Directions relate to uses under general exposure and other special conditions which produce rust, for machinery and implement finishes, heat-resistant and chemical resistant coatings, floor coatings, etc. Rust-Oleum Corp, Evanston, Ill.

MECHANICAL TRANSMISSION

N4 **SPEED REDUCER**—16-page bulletin No. 1105 illustrates and describes the new Falk concentric shaft speed reducer and right-angle shaft all-steel speed reducer. Information on service factors, dimensions, rating tables, method of selection, is provided. Falk Corp, 3001 W Canal St, Milwaukee 8, Wis.

N5 **GEAR COUPLING**—4-page folder explains simplified, 7-part construction of the Sier-Bath gear coupling. A check list of advantages is given, as well as photographs and descriptions of typical installations. Sier-Bath Gear & Pump Co, Inc, 9252 Hudson Blvd, North Bergen, N. J.

N6 **BELT DRIVE** — 4-page publication, entitled "What Is the Uni-Pull Drive," discusses elements of Uni-Pull drive and features 3 types of motor bases used on this drive. American Leather Belting Assn, 41 Park Row, New York 7, N. Y.

METERS AND INSTRUMENTS, MECHANICAL

T11 **FLOWMETER**—4-page bulletin No. FT presents informative data on the Foster Flow Tube, a new primary element for the measurement, regulation and control of fluid flow. Capacity curves and cross-sectional views are included. Foster Engrg Co, Union, N. J.

T12 **FLUID MEASUREMENT** — 12-page booklet No. G101 features the King-Gage—a hydrostatic instrument that directly shows weight, vol-

(*Continued on page* 192)

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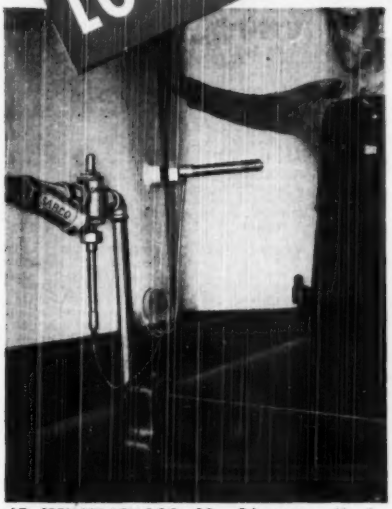
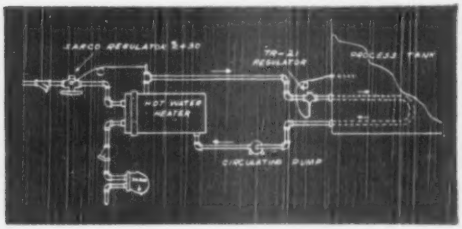
LOW COST *Insurance*

FOR HIGH COST OILS WITH SARCO TEMPERATURE CONTROL



AT SPENCER-KELLOGG CO., Edgewater, N. J.



The edible oils processed in this plant discolor or scorch only a few degrees above their melting points which range from 77° on cocoanut oil to 105° for soy bean oil. How to protect the several hundred thousand dollars worth of oils in these eight tanks, all requiring different temperatures, was the problem.

Sarco engineers studied the job and recommended hot water as the heating medium instead of steam. By keeping the heating coil surface just hot enough, but not too hot, scorching the oil is prevented but output maintained. Each tank is controlled by a TR-21 regulating the hot water flow and a 2430 controls the hot water supply temperature.

RESULTS: What was a constant worry to both management and the operators is now a 24 hour security. There is no possibility of discoloring because of too much heat, nor of caking because temperatures are too low. The human element is eliminated as a source of error — and of course, the tanks use less heat.

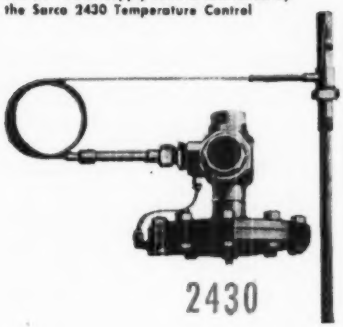
FOR YOUR TANKS: There are many combinations of Sarco Steam Traps and Temperature Controls for open and closed tanks, indoors or out. It costs nothing to find out what this kind of insurance would cost.

TR-21
TEMPERATURE REGULATOR

Each of the eight tanks is individually controlled by a Sarco TR-21

SARCO
PIPE-LINE
STRAINERS

Sarco self-cleaning pipe line strainers are placed ahead of each control



The hot water supply tank is controlled by the Sarco 2430 Temperature Control

301

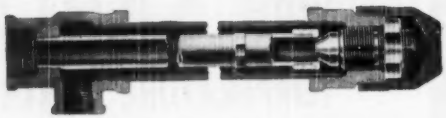
SARCO SAVES STEAM

SARCO COMPANY, INC.
Represented in Principal Cities
Empire State Building, New York 1, N. Y.
SARCO CANADA, LTD., TORONTO 8, ONTARIO

IMPROVES PRODUCT QUALITY AND OUTPUT

Nicholson Expansion Steam Traps

SET RECORD FOR LOW MAINTENANCE



FOR ALL STEAM OR HOT WATER EQUIPMENT

Radiators
Separators
Paper Machinery
Pipe Coils
Kettles
Railway Coaches
Dry Kilns
Vulcanizers
Switch Heaters
Laundries
Plastic Molding Presses, etc.

- Only One Moving Part
- No Pins, Bearings, Links to Wear Out

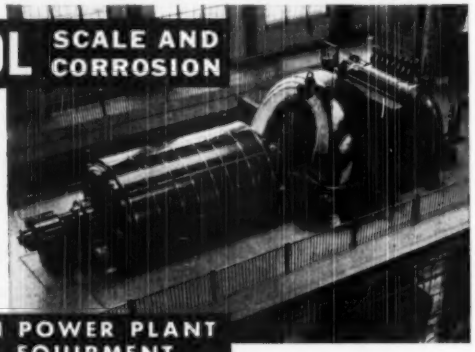
Here is an illustration of how Nicholson's extreme simplicity is cutting trap maintenance costs. In the 2 years Bradshaw & Co. have been distributing Nicholson expansion steam traps in the Pittsburgh area they have installed 444 units. Not one order for repair parts has been received. And examinations of traps in continuous service for at least 18 months, at steam pressures up to 250 lbs., have shown no valve cutting.

Other features: easily installed; discharge air as efficiently as water; no air binding; hardened stainless steel valve, seat. Lengths, 18" to 40". Press., 0 to 250 lbs. without change of valve or seat.

Catalog 250 or see Sweet's

W. H. NICHOLSON & CO.
125 OREGON STREET, WILKES-BARRE, PA.

CONTROL SCALE AND CORROSION



IN POWER PLANT EQUIPMENT

Control scale and corrosion in boilers, steam and condensate lines, water jackets, condensers — wherever water is used with WRIGHT WATER-CONDITIONING CHEMICALS.

There is a Wright Field Engineer near you who will help with your water conditioning problems.

BOOTH 360
NATIONAL CHEMICAL EXPOSITION
CHICAGO • SEPT. 5-9

Wright CHEMICALS

WRIGHT CHEMICAL CORPORATION
Specializing in Water Conditioning
GENERAL OFFICES AND LABORATORIES: 617 W. LAKE ST., CHICAGO 6, ILLINOIS
Offices in Principal Cities
SOLE DISTRIBUTOR OF NELSON CHEMICAL PROPORTIONING PUMPS

ume or depth of liquids in storage or in process. Details on construction, together with complete specifications on 5 standard sizes are given. King Engrg Corp, Box 300, Ann Arbor, Mich.

PIPING, FITTINGS, VALVES AND SPECIALTIES

U15 **STRAINERS AND SEPARATORS** — 16-page catalog No. R-46-50A contains descriptions, dimensions, weights and list prices of the entire line of Adsco Y- and T-Type strainers, suction strainers, multi-flow separators and receiver - separators. American District Steam Co, North Tonawanda, N. Y.

U16 **AIR TRAPS** — 4-page bulletin No. 202 covers the selection and installation of air traps for automatic drainage of moisture from compressed air intercoolers, aftercoolers, receivers, separators and drip points. Armstrong Machine Works, Three Rivers, Mich.

U17 **UNIONS AND VALVES** — 22-page booklet No. 11 illustrates complete line of Catawissa hot forged steel unions and valves. Data, specifications and prices are included. Also pictured are both standard and double extra heavy hot forged steel unions as well as the full stainless steel and alloy steel unions. Catawissa Valve & Fittings Co, Catawissa, Pa.

U18 **PIPE FITTINGS** — Bulletin No. 104 describes complete line of Kennedy cast-iron, malleable and bronze fittings. Also covers recent additions of cast-iron screwed, flanged, sprinkler and extra-heavy malleable fittings. Kennedy Valve Mfg Co, Elmira, N. Y.

U19 **STEAM TRAP** — 4-page folder No. 115-P features the Series 100 steam traps for use with heating systems, drying and processing equipment. Specifications and prices are listed. Large labeled "X-ray" view included. Stickle Steam Specialties Co, Indianapolis 18, Ind.

U20 **PIPE THREADING EQUIPMENT**—8-page catalog No. A411 contains sizes and list prices, as well as illustrations of pipe threading equipment. Armstrong Mfg Co, Bridgeport, Conn.

U21 **RUBBER PIPE** — 8-page bulletin No. H-1 explains applications and comparative qualities of flexible rubber pipe. Economies in costs of installation and maintenance are explored in detail. Case histories are cited. Hewitt Rubber Div, Hewitt-Robins Inc, 240 Kensington Ave, Buffalo 5, N. Y.

U22 **STEAM TRAPS**—4-page folder No. 101 covers Squires steam and air traps for pressures up to 600 lbs. How to size and install is explained in detail. Prices, capacities, and dimensions are also given. C E Squires Co, 18502 Syracuse Ave, Cleveland 10, Ohio.

PRIME MOVERS AND ACCESSORIES

V3 **MULTISTAGE TURBINE** — 12-page booklet No. S-146 explains the Terry multistage turbine design. Illustrated with photos and drawings it gives data on casing, lagging, blades, nozzles, wheels, shafts, diaphragms, bearings, interstage and end glands, governors, synchronizers, governor and nozzle control valves, etc. Terry Steam Turbine Co, Dept P, Hartford, Conn.

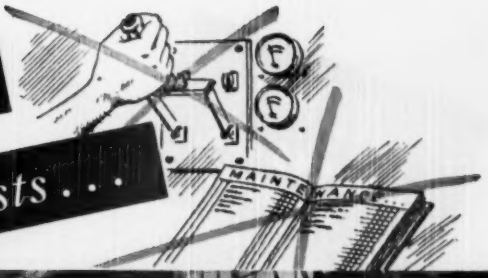
V4 **HYDRAULIC TURBINES** — 56-page catalog No. 02B7301 describes the design and construction of Francis, propeller and impulse type, hydraulic turbines and such auxiliaries as pressure regulators, special high head valves, butterfly valves and cabinet type governors for large units. A section explains the firm's ability to produce hydraulic turbines of any practical magnitude. Allis-Chalmers Mfg Co, 952 S 70th St, Milwaukee, Wis.

PUMPS

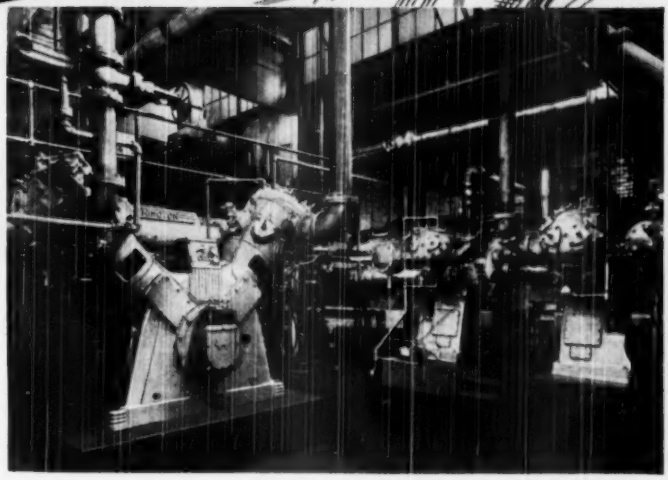
W7 **CENTRIFUGAL PUMPS**—Bulletin No. W-306-B1 discusses Monobloc centrifugal pumps, types DN,

No Shutdowns . . .

No Repair Costs . . .



IN 30 MONTHS OF STEADY OPERATION!



Three Worthington YC-2 Compressors on general air service in the Reo Motors Company Plant, Lansing, Michigan. Two of these units ran for 2½ years, the other (a later installation) for 2 years, before all three had their first routine examination. During that time they operated approximately 16 hours per day, 5 days per week, without a single shutdown for maintenance.

Worthington YC-2 Compressors Provide Reo Motors Plant With Trouble-Free, Low-Cost Air Service

Freedom from maintenance worries is just one of the many advantages you get with Worthington YC-2 Compressors. Installation is quick, easy and inexpensive. A YC-2 comes completely assembled — there's no alignment problem and you don't need an erecting engineer. Requiring only half the space and one-quarter the foundation of same-capacity horizontals, it's ready for work as soon as connections are completed — at big savings in time, labor and money.

You get steady savings on operating costs, too, thanks to advanced features like the balanced Y-frame for higher rpm . . . the power-thrifty, instantly responsive 3 and 5-step variable capacity control . . . and Worthington Feather* Valves, most efficient and economical ever made.

GET ALL THE FACTS

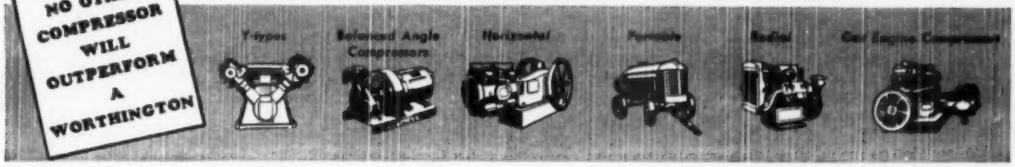
on how YC-2's can cut your air costs — from the first day on! Bulletin L-667-B1A gives you the whole economy story with further proof that *there's more worth in Worthington*. Write to *Worthington Pump and Machinery Corporation, Compressor Division, Buffalo, New York.*

WORTHINGTON

*Reg. U.S. Pat. Off.

KO.4

NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON



NOW... "PUSH-BUTTON" UNLOADING PRICED LOW ENOUGH FOR ALL!

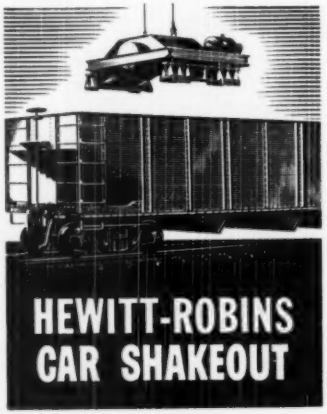
Fast, efficient car unloading can now be yours *at a cost so low you can no longer afford makeshift methods!*

Hewitt-Robins, originators of the Car Shakeout which has unloaded over 400 million tons of material from hopper bottom cars, makes this possible with the *all new* Hewitt-Robins GS Shakeout. This powerful, rugged shakeout—ideal for the smaller-size plant—is designed to unload *up to 15 cars a day*, yet is so economical you can afford to use it for *only two or three cars a day.*

Built-in controlled vibratory action makes the Hewitt-Robins GS Shakeout completely effective and enables the use of smaller, lighter, less expensive hoist and supporting structures—another economy feature for the smaller plant.

And remember, the Hewitt-Robins GS Shakeout gives you all the *plus* advantages introduced by the original Hewitt-Robins HD Car Shakeout: (1) you save time, (2) you save labor, (3) you save money, (4) you reduce demurrage charges, and (5) you eliminate danger to workers.

Learn more about this better, *proven* way to unload hopper cars! Write Robins Conveyors Division, Hewitt-Robins Incorporated, Passaic, N. J.



HEWITT-ROBINS (HR) INCORPORATED

BELT CONVEYORS (*belting and machinery*) • BELT AND BUCKET ELEVATORS
CAR SHAKEOUTS • DEWATERIZERS • FEEDERS • FOAM RUBBER PRODUCTS
FOUNDRY SHAKEOUTS • INDUSTRIAL HOSE • MINE CONVEYORS • MOLDED RUBBER GOODS
RUBBERLOKT ROTARY WIRE BRUSHES • SCREEN CLOTH • SKIP HOISTS • STACKERS
TRANSMISSION BELTING • VIBRATING CONVEYORS, FEEDERS AND SCREENS

DNE, DDN, DDNE and DNH, & single- and two-stage, size 1 to 5. The pumps are designed for small boiler feed, cooling service and condensate service as well as circulation systems and sanitary drinking water supply. Worthington Pump & Mchy Corp, Harrison, N. J.

W8 **ROTARY PUMP**—8-page booklet No. L313A-B describes the new De Laval A313A Imo pump, a general service screw-type rotary pump designed for pumping petroleum products, and other light or viscous fluids as required for rotary and steam atomizing oil burners, oil transfer, lubrication, hydraulic systems, etc. Capacities to 85 rpm—pressures to 150 psi. De Laval Steam Turbine Co, Trenton 2, N. J.

WATER TREATMENT

X4 **WATER SERVICES** — 4-page folder, entitled "Let's Consider Your Whole Water Problem," tells about the firm's industrial water engineering services offered in the fields of water procurement, treatment, usage and disposal. Typical service problems are discussed, with illustrations showing flow schemes of water in process and disposal. Hall Laboratories Inc, Hagan Bldg, Pittsburgh 30, Pa.

X5 **BOILER WATER CONDITIONING**—16-page bulletin No. SM-9020 explains methods of applying treating chemicals to boiler feedwater systems and boiler drums. Proportioneers Inc, 9 Codding St, Providence 1, R. I.

X6 **REACTORS**—16-page publication No. 5001 features the Cochrane-Liquon sludge contact reactor for the clarification and softening of cold water. Operation, applications and advantages as well as illustrations are given. Cochrane Corp, 17th St & Allegheny Ave, Philadelphia 32, Pa.

X7 **DEIONIZATION** — 12-page booklet, entitled "Amberlite Monobed Deionization," consists of the history, behavior, present performance and potential uses of Monobed ion exchange systems in water-conditioning, chemical process and other industries. Resinous Products Div, Rohm & Haas Co, Washington Sq, Philadelphia 5, Pa.

X8 **STABILIZER**—8-page folder describes Calgon, a material that stabilizes the dissolved iron and manganese so that the water remains clear. Method of treatment and some typical experiences are listed. Calgon Inc, Hagan Bldg, Pittsburgh 30, Pa.

WELDING

Y5 **WELDING SUPPLIES** — 8-page bulletin No. 467 shows the Lincoln line of welding supplies, including electrode holders, connectors, wire brush, ground clamps, cable lugs, arc torch, protective shields, welding cable, etc. Lincoln Electric Co, 12818 Coit Rd, Cleveland 1, Ohio.

Y6 **AC WELDER**—Broadside No. 1301 features the Lincoln 200 amp Fleetwelder, which simplifies ac arc welding. Specifications, typical applications are given. Lincoln Electric Co, 12818 Coit Rd, Cleveland 1, Ohio.

OTHER EQUIPMENT

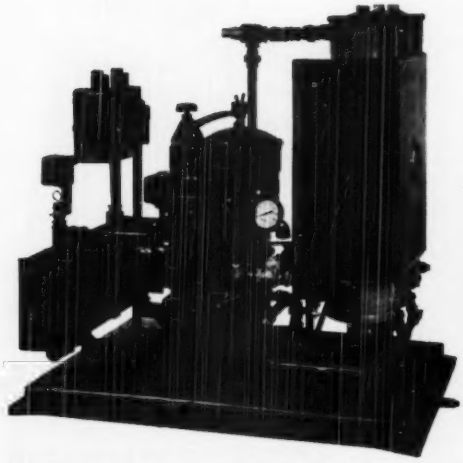
Z11 **EQUIPMENT SUPPLIES** — 32-page catalog No. 550 itemizes babbitted journal boxes, roller bearing pillow blocks, centrifugal slurry pumps, water valves, conveyor takeups, roller holdbacks, and perforated steel screen plates. Also included is specification information on conveyor and drive pulleys, V-belt sheaves, gears, sprockets, shafts and keys. All equipment listed is for heavy duty service. McNally Pittsburg Mfg Corp, Pittsburg, Kansas.

Z12 **NICKEL ALLOYS**—2 bulletins, 24-pages each, are offered. No. T-7, in addition to information on Inconel, contains material on Inconel "X", one of the newer age-hardenable Inco nickel alloys. No. T-9 deals with engineering properties of "K" Monel and "KR" Monel. Both bulletins contain charts, tables on compositions and prop-

3 YEARS OF EXPERIENCE PROVE THE "PURI-FILTER" IDEA IS SOUND

The De Laval "Puri-Filter" — centrifuge plus filter — has now been on the scene approximately three years. The numerous installations made during that time now give ample proof that the basic idea behind the "Puri-Filter" is correct. Centrifugal force and micronic filtration can do a more thorough job of cleaning diesel oil than any other device in existence, and better, in fact, than either centrifugal force or filters by themselves. It is economical, too — the centrifuge relieves the load on the filters and lets them remain in service longer.

The De Laval "Puri-Filter" removes the materials that cause ring sticking, sludging and coking. Dirt, water and colloidal carbon are all promptly separated out of the oil, which is left clean and clear in color, and ready for indefinite re-use.



THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

DE LAVAL *Oil Purifiers*

FOR DIESEL LUBRICATING OIL

you save steam when your condensers are Oakite-clean!

WHEN condenser tubes are scale-fouled, a lot of BTU's go up the stack. So if limescale is reducing the efficiency of your condenser performance, switch to low-cost Oakite cleaning and descaling to eliminate serious heat-transfer difficulties. That way you get maximum value out of every fuel dollar.

It's Easy!

To handle the job efficiently, economically, there are scientifically designed Oakite alkaline materials for fast, easy cleaning of the steam-side of your condensers. For descaling the water-side surfaces, there are safe, thorough acidic Oakite descalants.

• Data Yours FREE

You can get the facts about these effective Oakite compounds and full step-by-step details by contacting your nearby Oakite Technical Service Representative. Or send today for your free copy of the illustrated "Oakite 71 Digest"—and read the Oakite story of condenser-cleaning. Write to

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23 Thames St., N. Y. 6, N. Y.

SPECIALIZED INDUSTRIAL CLEANING
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erties, working instructions, etc. International Nickel Co, Inc, 67 Wall St, New York 5, N. Y.

Z13 **TUBE BENDERS** — 60-page catalog No. 50 pertains entirely to bending, warehousing and fabricating of pipe and tubing. Photographs and specifications are included. Wallace Supplies Mfg Co, 1300 Diversey Parkway, Chicago 14, Ill.

Z14 **THERMOCOUPLES** — 8-page catalog section No. 22 describes and illustrates industrial thermocouples for all pyrometers. Thermo Electric Co, Inc, Fair Lawn, N. J.

Z15 **GLASS INSULATION**—36-page booklet No. 37-B contains the complete story on normal temperature (50 - 150 F) applications of PC Foamglas, the long-life industrial insulation. Pittsburgh Corning Corp, 307 Fourth Ave, Pittsburgh 22, Pa.

Industrial Research Lab Nearly Complete

Started back in 1946 the General Electric Co research laboratory is nearing completion. Exclusive of minor service buildings, the laboratory plant totals five buildings with a usable area of about 185,000 sq ft.

This includes the main five-story building with 160,000 sq ft of space, the Radiation Laboratory where the 300,000,000-volt synchrotron and other atom-smashers will be installed, a low-temperature laboratory where helium is liquefied for studying effects at temperatures near absolute zero (460 F below zero), a chemical pilot plant to try out chemical processes on a larger scale than possible in laboratory rooms and others.

A series of vertical shafts at 12-ft intervals on both sides of the halls of the five-story main building carry such services as direct and alternating current electricity of various voltages, oxygen, hydrogen, nitrogen, illuminating gas, compressed air, vacuum, steam, distilled water, city water and a drain.

Guy B Panero, engineers, has been selected by Societa Generale Immobilaire to do the engineering for a new 11-story hotel in Rome, one of the largest to be constructed there since the war. The entire building will be air conditioned.

General Electric Launches Program

The Taunton, Mass. plant of the General Electric Co, Plastics Div, will undergo a $1,000,000 improvement program to make it one of the largest plastics operations in the country according to Herbert M Brusman, manager of the plastics div.

Plans are being made to alter nearly all interior sections of the plant and to modernize equipment for maximum production efficiency. Presses with the newest and fastest controls now known to the industry will go in. The plant is scheduled for completion about the end of 1950.

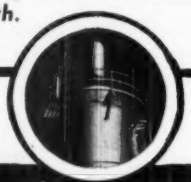
Georgia Power Co will start construction soon of a $5,000,000 steam generating plant at Brunswick. First unit will be a 30,000-kw one with ultimate steam capacity of four such units. The plant will operate at 850 psi, 900 F.

If your plant requires

- DIRECT HEATING OF VAPORS
- DIRECT HEATING OF LIQUIDS
- DOWTHERM INDIRECT HEATING
- STEAM GENERATORS
- STEAM SUPERHEATERS
- WASTE HEAT BOILERS

place the selection of the specific type in specialized hands . . . and obtain optimum efficiency.

Petro-Chem Development Company engineers are heating specialists . . . they can supply the whys and wherefores of indirect versus direct heating and the economics of both.



Every day more than 600, oil and gas fired, Petro-Chem Iso-Flow* installations in the petroleum, chemical and allied industries, demonstrate the efficiency of their design and installation.

***Patents issued and pending**

PETRO-CHEM DEVELOPMENT CO., INC.
120 East 41st Street, New York 17, N. Y.

Representatives:
Bethlehem Supply, Tulsa and Houston • Flagg, Brackett & Durgin, Boston • D. D. Foster, Pittsburgh • Faville-Levally, Chicago • Lester Oberholz, Calif.

Progressive

FAIRFIELD

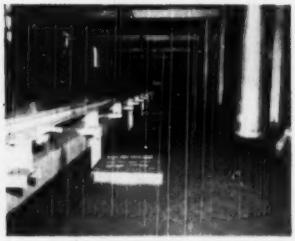
Engineering

SERVING THE NATION'S POWER PLANTS

PLANNED EFFICIENCY AT WORK!!

● There was a time when watch mechanisms were considered intricate, but today's power plant coal handling systems can well share the same distinction. Take the southern rayon plant installation pictured above recently completed by Fairfield. Five conveyors supply coal to the powerhouse bunkers or to optional ground storage in a timed and synchronized capacity cycle. From the time the coal hits the double track hopper until it rests in the bunkers, Fairfield planning and engineering assure the efficient performance of this coal handling system. Take advantage of this outstanding experience and engineering know-how today by calling in your Fairfield engineer.

View down walkway alongside elevator belt. Note extensive ground storage area.



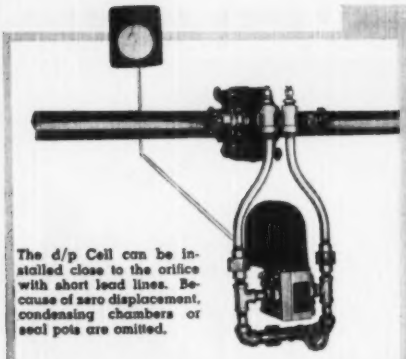
Distributing belt conveyor over bunker. Automatic tripper in background.

THE FAIRFIELD ENGINEERING COMPANY

BUILDERS OF DEPENDABLE COAL AND ASH HANDLING EQUIPMENT

335 CHICAGO AVENUE

Marion, Ohio



The d/p Cell can be installed close to the orifice with short lead lines. Because of zero displacement, condensing chambers or seal pots are omitted.

Simpler Flow Measurement

in the palm of your hand

NEW • REVOLUTIONARY • MERCURY-LESS

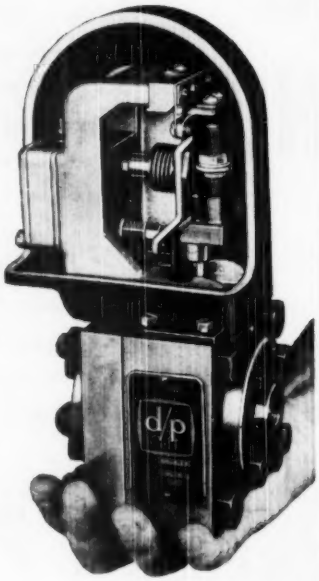
FOXBORO

DIFFERENTIAL PRESSURE CELL

How you can simplify many troublesome flow problems . . . especially those where corrosion is a factor or the use of mercury is objectionable. This unique flow measuring device is accurate, easily calibrated, and widely applicable, and it weighs only 20 lbs.

The Foxboro d/p Cell operates on the highly-accurate force-balance principle, transmitting flow measurement to remote, conveniently-located pneumatic receiving instruments (indicating, recording, controlling). Range: 80 in. to 800 in. H_2O. Working pressures: 750 psi and 1500 psi.

Get all the facts about this revolutionary new device for the measurement of liquid, steam, gas or air flow. Write for Bulletin 420. **The Foxboro Company, 68 Neponset Ave., Foxboro, Mass., U.S.A.**



UNIQUE ADVANTAGES

1. *Type 316 Stainless Steel Construction.*
2. *Uses no mercury.*
3. *Essentially zero displacement — no need for condensing chambers on steam measurement or seal pots on liquid measurement.*
4. *Immediate, unfailing response to differential pressure changes.*
5. *Positive overrange protection.*
6. *Easy zero and range adjustment.*

FOXBORO REG. U.S. PAT. OFF.

RECORDING • CONTROLLING INDICATING INSTRUMENTS

APPOINTMENTS

Golden-Anderson Valve Specialty Co, Pittsburgh, Pa., has announced the election of Grant A Colton as vice-president and general manager.

Irving M Malsch succeeds Carl P Quanz as Chicago district manager for **Bridgeport Brass Co.** Quanz is promoted to plant manager in charge of all activities at the firm's Indianapolis mills. David I. Nesler replaces Malsch as Indianapolis district sales manager.

Food Machinery & Chemical Corp reports election of Gerald F Twist as vice-president of the corporation. Twist is manager of FMC's Peerless Pump Div with headquarters at Los Angeles.

George I Bottcher has become chief engineer of **Allegheney Ludlum Steel Corp.** Simultaneously, J F Chapman and R E Smith have been made assistants to Bottcher. All three will be headquartered in the firm's general offices at Brackenridge, Pa. Also, Royden C Presley has succeeded C H Vaughan, who resigned, as Birmingham, Ala., district sales manager.

Combustion Engrg-Superheater Inc, announces the following appointments in its New York office: F J Murphy, general purchasing agent; B A Anderson, production manager; Myron F Freeman, manager of service and erection dept.

Charles J McWhinnie is manager of **Chase Brass & Copper Co's** new sales office located at 1421 Court Place, Denver, Colo. Assisting McWhinnie, as office manager, will be John M Ceranich. Territory includes states of Colorado, Idaho, Montana, Wyoming, Utah, and New Mexico, as well as the county of El Paso, Texas. Also, Mead W Batchelor joins the firm as works manager in Cleveland, Ohio.

Dearborn Chemical Co, Chicago, has made Lester R Sagar process manager. He will supervise production planning and development of process equipment.

W J Goerisch is now manager, power apparatus sales, for **Graybar Electric Co,** New York City. B P Van Inwegen replaces Goerisch as manager, lamp sales.

Jeffrey Mfg Co announces the removal of its district office in West Virginia from Huntington to 403 City Ave, Beckley. E H Hebden is manager and will continue to serve both the industrial and mining fields in that territory.

Peabody Engrg Corp has appointed Allen H Jones as manager of its newly-opened Chicago office.

Charles F Childress Co, 54 Monument Circle, Indianapolis, Ind., has been chosen representative by **D J Murray Mfg Co** for Grid unit heaters. Territory covers the states of Indiana, except La Porte, Lake and Porter counties; and in the state of Ohio, Williams, Putnam, Auglaize, Fulton, Van Wert, Shelby, Defiance, Allen, Darke, Henry, Paulding, Mercer and Miami coun-

VARIETY

is not the spice of life here but it

Permits Piping Improvement

Midwest offers a large variety of welding fittings to help you improve your piping. Many of these fittings were originated by Midwest for the purpose.

For example, the Midwest Reducing Elbow saves a third of the welding, decreases turbulence and pressure drop and improves appearance when used instead of a standard elbow and reducer. Midwest Long Tangent Elbows have a tangent or straight section at each end equal to ¼ the nominal pipe size; this saves pipe, saves time in lining up, and often saves welding. (These are in addition to ASA Type and Short Radius Elbows.) Midwest Sleeves relieve the line butt weld of all bending stress and much of the tensile stress. Midwest Saddles restore the original pipe strength and reinforce the joint.

Use of Midwest Welding Fittings assures maximum improvement and economy in piping. For your welding fitting needs, get in touch with the Midwest Distributor near you.

MIDWEST

PIPING & SUPPLY COMPANY, Inc.

MAIN OFFICES: 1450 SO. SECOND STREET, ST. LOUIS 4, MO.
Sales Offices: New York 7—30 Church St. • Chicago 3—79 W. Monroe St.
Los Angeles 33—520 Anderson St. • Houston 2—1213 Capitol Ave.
Tulsa 3—224 Wright Bldg. • Boston 27—426 First St.
Stocking Distributors in All Principal Cities

MIDWEST WELDING FITTINGS Improve Piping Designs and Reduce Costs

COMING SOON!

Outstanding presentation of equipment for production and utilization of steam, electric, and mechanical power — for YOUR benefit —

featuring:

- Over 300 informative displays and interesting demonstrations of latest developments for improving power production and utilization.
- Hundreds of new cost-saving ideas on design, installation, operation, maintenance, modernization, and expansion.
- Discuss your problems and future plans with exhibitors' technical experts.

Plan to Attend — You'll Be Glad You Did!

Auspices A.S.M.E. in conjunction with Annual Meeting
Management International Exposition Co.

ties on a permanent basis—everything west of, and including, the counties of Adams, Greenfield and Fayette on a temporary basis. In the state of Kentucky, Jefferson county only.

Kenneth P Hengesbach joins **Swartwout Co** as power plant equipment sales engineer in the company's Philadelphia district office.

Tilco-Fin Div, David E Kennedy Inc, Brooklyn, N. Y., has selected Brock Mott, 2627 S Boston Place, Tulsa, Okla., as district representative for the states of Texas, Oklahoma, Kansas and Nebraska.

General Electric Co announces following appointments in its transformer and allied products divisions at Pittsfield, Mass.: B W Mahoney becomes assistant manager of sales and Max I Alimansky succeeds him as assistant manager of manufacturing. W Scott Hill is named manager, commercial engineering div. William S Ginn replaces Francis E Fairman Jr as manager of sales. Fairman is now general sales manager of G-E's large apparatus divisions in Schenectady, N. Y. Other changes in Schenectady are as follows: A K Bushman becomes manager of industry divs. Charles C Leader is named staff assistant to E E Johnson, manager of engineering, large apparatus divs. John R Casey is now manager of newly established gas turbine sales div. James L McFarland becomes manager of engineering, industrial heating engineering div. Horace Zimmer is named manager of districts for Apparatus Dept. Frank A Faron succeeds Zimmer in New York City as district manager.

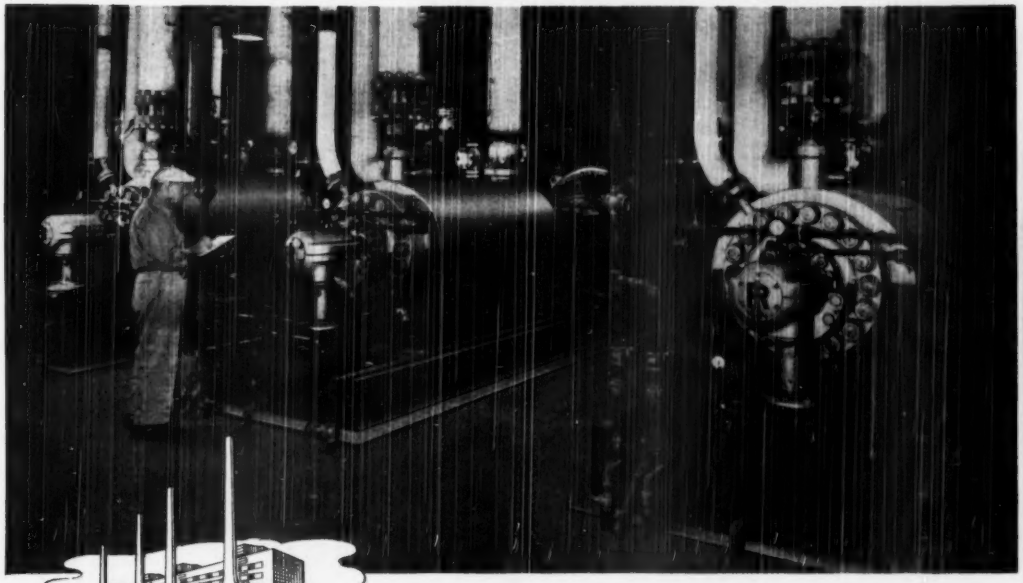
Additional **G-E** appointments include the following: John L Busey has been elected a vice-president and placed in charge of marketing policy. William V O'Brien has been elected a commercial vice-president and made assistant manager of marketing policy for the company. Charles R Pritchard has been elected president and a director of G-E Supply Corp. Busey and O'Brien will establish headquarters in New York and Pritchard in Bridgeport, Conn. At Lynn, Mass., Arthur W Bartling has been named general sales manager of small apparatus div. Thorn L Mayes has become manager of motor engineering div of G-E's small and medium motor divs.

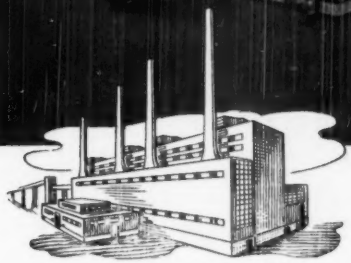
Ralph E Donnelly is promoted to assistant manager of **General Electric** turbine sales div at Fitchburg, Mass. In St. Louis office John J Miller becomes manager of industrial div, Apparatus Dept Mid-States district. Robert C Hanna is made manager of sales of fractional-horsepower motor divs at Fort Wayne, Ind. Also, Dwight E Moorhead is appointed manager of G-E's motor divs in San Jose, Calif.

Republic Flow Meters Co assigns Ralph E Homes as manager of its Cincinnati district with office at 3197 Linwood Ave. Territory includes central, western and southern Ohio and eastern Kentucky.

Infilco Inc announces relocation of its research, development and engineering divs, as well as its general offices. On and after Sept 1, these departments and offices will

NEW PHILIP SPORN STATION TO INSTALL 24,000 HP OF I-R BOILER-FEED PUMPS





Twelve Ingersoll-Rand "double case" pumps, operating at 2395 psi, will handle all boiler-feed water for the four 150,000 kw units

This new high-pressure steam generating plant, named in honor of Philip Sporn, president of the American Gas and Electric Company, will serve the company's vast interconnected system in the seven states of Michigan, Indiana, Ohio, Virginia, West Virginia, Kentucky, and Tennessee. Designed by and constructed under supervision of the American Gas and Electric Service Corporation, it will eventually make available 900,000 kw of net output capability to meet the system's rapidly increasing demands for electric power.

The new Philip Sporn Station of the American Gas and Electric Company System, near New Haven, West Virginia, represents the last word in steam plant design. The first generating unit with a net output capability of 150,000 kw, went into commercial operation in January 1950. Three additional units, which are already under construction, will bring the plant net output capability to 600,000 kw.

Each of these four generating units will be served by three Ingersoll-Rand Class CHTA, 11-stage, "double case" pumps—two for full load requirements, and the third for stand-by service. Three of these feed pumps are shown above, direct connected to 2000 hp, 3570 rpm motors. Each pump is designed to handle 1100 gallons per minute, at 2395 psi and 304° F.

Here, as in all high-pressure steam plants, the accent is on *dependability and continuity of service*. And Ingersoll-Rand boiler-feed pumps have repeatedly proved their ability to stay on the job year after year under the most severe operation conditions. That's why they're *first choice* for really high pressure service.

PUMPS • COMPRESSORS
AIR AND ELECTRIC TOOLS
DIESEL ENGINES • ROCK DRILLS
VACUUM EQUIPMENT • CONDENSERS

Ingersoll-Rand
11 BROADWAY, NEW YORK 4, N. Y. 537-10

IN THOUSANDS OF PLANTS...
HOFFMAN TRAPS
ARE STOPPING STEAM WASTE
50 SERIES FLOAT and FLOAT & THERMOSTATIC TRAPS
All working parts are mounted on the cover. Pressure range to 125 lbs. Capacities up to 12000 lbs. condensate per hour
HOFFMAN RADIATOR TRAPS
Removable thermal units and seats are a distinguishing feature of Hoffman Traps, greatly simplifying clean-out and inspection work. Pressure range 0 to 125 lbs. Capacities up to 1250 lbs. condensate per hour.
600 SERIES INVERTED BUCKET TRAP
Straight-through pipe connections, all working parts connected to bonnet and easily removed with it. Interchangeable valve seats for various pressures. Pressure range 0 to 200 lbs. Capacities up to 5000 lbs. condensate per hour.

Here's two easy steps to "more heat from less fuel" for next winter.

First, check carefully all valve pins and seats of steam traps and replace units which are not functioning.

Second, install additional valves, traps or pumps where good steam-plant engineering indicates their need.

And, here's the big pay off, once Hoffman Traps are installed, it's a simple matter to make periodic inspection—as all working parts are mounted on the covers, easy to get at. Modernizing your steam plant with Hoffman Specialties is obviously not an expense, but a long term investment paying immediate dividends in lower operating costs.

HOFFMAN SPECIALTY COMPANY, Dept. P-9, 1001 York St., Indianapolis 7, Ind.
Famous for HOFFMAN VALVES, TRAPS, VACUUM AND CONDENSATION PUMPS, FORCED HOT WATER HEATING SYSTEMS — Sold by leading Wholesalers of Heating and Plumbing Equipment

HOFFMAN
Steam
TRAPS

be located in Tucson, Ariz. They will occupy temporary quarters at 2750 S Twelfth Ave while a new building is being built. Manufacturing, chemical laboratories, advertising and certain phases of engineering will continue in the present Chicago plant.

Cleveland office of **Robins Conveyors Div,** Hewitt-Robins Inc, has moved to new quarters at 8905 Lake Ave.

Charles W McHose is chosen to represent **Springfield Boiler Co** in New York City and surrounding territory. His offices are at 92 Liberty St.

Link-Belt Co announces that its public relations activities are being expanded, and that a separate public relations department has been established at executive headquarters, 307 N Michigan Ave, Chicago, headed by Harlan B Collins and Russell B Kern. Advertising dept has been strengthened by appointment of Bertram V Jones as executive assistant advertising manager. Jones will be directly assisted by John F Kelley, assistant advertising manager.

Evans L Shuff & Associates, 303 Five Ivy Bldg, will represent **Graver Water Conditioning Co** in the Atlanta, Ga. territory. James T Potter, 1521 Stanford Place, Charlotte, N. C., will represent the firm in North and South Carolina.

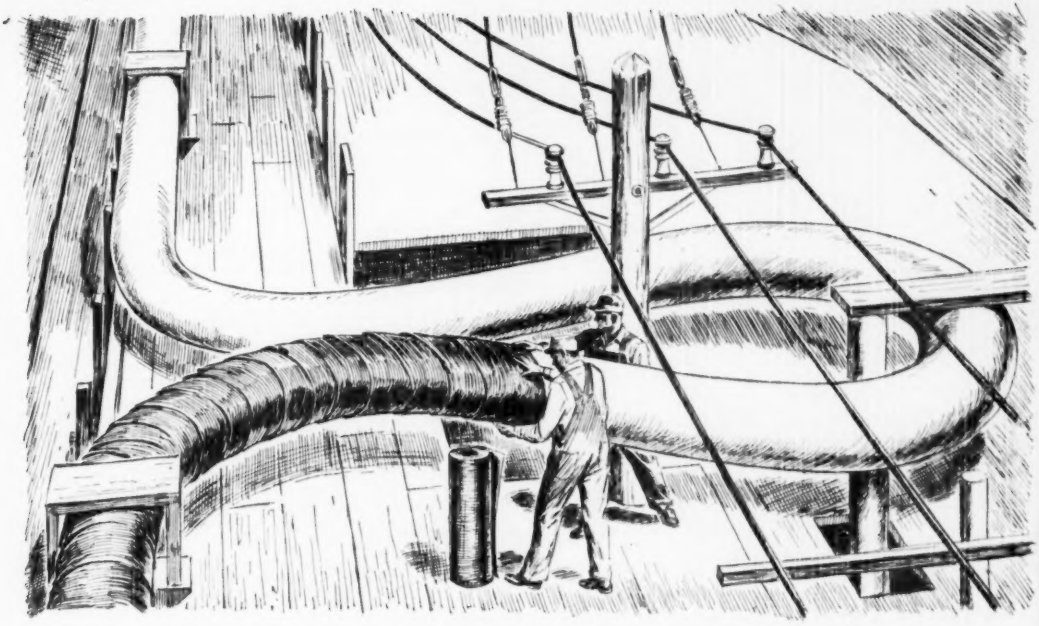
Westinghouse Electric Corp, Pittsburgh, names George H McBride to succeed L R Botsai as manager of its gearing div. Botsai replaces Leon R Ludwig as manager of motor and control div in Buffalo, N. Y. Ludwig returns to Pittsburgh as a member on the staff of John K Hodnette, vice-president of the firm. Westinghouse Electric Supply Co elects John F Myers president to succeed David M Salsbury. Salsbury is now vice-president in charge of Texas and Pacific Coast operations of the Supply Co with headquarters in San Francisco.

Landis O Morris Jr has been assigned to the staff of Robert S Tyler Jr, manager of Tulsa office of **Tube Turns Inc.** Thomas Robertson & Co, Ltd, Montreal, has been appointed a distributor for both Tube Turns and Tube Turns of Canada, Ltd.

Position of central sales manager, directing the sales of Buffalo, Detroit, Cleveland, Cincinnati and Pittsburgh offices for **Worthington Pump & Machy Corp,** has been filled by William A. Meiter. John W Stovall has succeeded Meiter as manager of the Buffalo district sales office. William J Millet has replaced E M Detwiler, who resigned, as works manager of Holyoke Works, Mass. Thomas F Quinlan has been appointed works comptroller at Harrison, N. J., to succeed the late Wilbur H Stacy.

S W Collins, 419 Ritz Bldg, Tulsa, Okla., will represent **Alloy Steel Products Co** in the states of Oklahoma and Kansas.

Manning, Maxwell & Moore Inc, Bridgeport, Conn., names Chester H Butterfield vice-president in charge of Consolidated-Ashcroft-Hancock Div. Butterfield succeeds



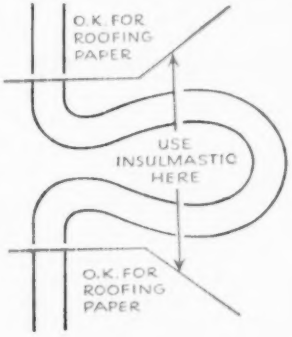
What's wrong with this picture?

There's nothing wrong with weatherproofing an outdoor steam line with roofing paper—as far as the straight sections go, but on the expansion loop, this method won't work so well.

Roofing paper can be wrapped smoothly and wired in place around straight runs of pipe covering, but, on any curve, the edges of the paper flare out instead of hugging the line snugly. The paper gapes, forms pockets which catch rainwater, and wind getting under the paper can soon tear and loosen it.

A plastic coating like Armstrong's Insulmastic is more efficient on bends and loops. First, two coats of asbestos cement are applied over the covering. The second coat is left rough to key with the first of two coats of Insulmastic which follow. No painting or further finish is required.

Insulmastic is flexible enough to "give" as the loop expands and contracts. It goes on rapidly, does not crack or scale, and provides many years of dependable protection against the deteriorating effects of weather.



Often small details, like this one, have great effect on the life and efficiency of an insulation job. Armstrong engineers know where the spots that can cause trouble are, and they know how to choose the materials and methods that will stop that trouble before it starts. The next time you have heat insulation work to be done, call in one of these men. In addition to his practical advice, he can furnish you with quality materials and skilled workmen to apply them. Just phone the Armstrong office nearest you or write today to Armstrong Cork Company, 7009 Maple Avenue, Lancaster, Pennsylvania.

ARMSTRONG'S INDUSTRIAL INSULATIONS

MATERIALS - INSTALLATION

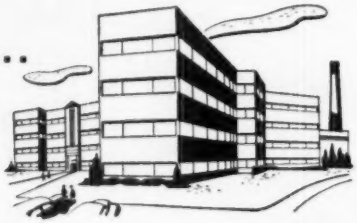
FOR ALL TEMPERATURES FROM 300° F. BELOW ZERO TO 2600° F.

CORAVOL CASE HISTORY NO. 5

5th in a series describing CORAVOL results in steam systems

Type of Operation...

HOSPITAL



OPERATING CONDITIONS: 180,000 lbs. evaporation per 24 hours.

25% make-up.

Boiler pressure—75 psi.

Steam used for heating, laundry, sterilizing and cooking.

PROBLEM: Internal corrosion of lines of steam system, requiring numerous replacements.

CORAVOL STARTED: April 1940.

RESULTS: Replacements of lines and fittings of steam system practically eliminated.

USER COMMENTS: Removal of old rust deposits throughout steam system was gradual and no stoppage resulted in lines or traps.

STOP STEAM SYSTEM CORROSION

with **CORAVOL** (the original* AMINE PROCESS)

CORAVOL in your steam system (1) prevents corrosion in lines, (2) cleans out clogging rust deposits. Thus, CORAVOL *protects lines;* improves heat transfer; restores original capacity of lines and efficiency of valves and traps.

CORAVOL is *not* a boiler feed water treatment—it is designed expressly for use in steam systems. Because **CORAVOL** volatilizes and condenses with the steam, it circulates throughout your entire steam system and protects *all* zones from corrosive attack.

*The use of CORAVOL in steam systems is covered by U. S. Patent No. 2053024. The Western Chemical Co., owner of this patent, grants licenses under which volatile AMINES purchased from other sources may be used in steam systems upon payment of royalty to Western Chemical Co.

CORAVOL IS PART OF A COMPLETE TECHNICAL SERVICE which provides special formulas of chemical treatment for: boiler feed water . . . hot water supply . . . refrigerating brine . . . cooling and condenser water . . . rapid scale removal . . . coagulation . . . algae control . . . fuel oil supply . . . soot removal.

WRITE TODAY for complete *free* data about the CORAVOL process.

WESTERN CHEMICAL COMPANY

713 Washington Street — Kansas City 6, Missouri

Hamilton Merrill, who was recently elected president of the company. Erling Klafstad becomes assistant director of engineering for Hancock valves and Consolidated safety and relief valves.

Brady-Milwaukee Div, W H Brady Co, Chippewa Falls, Wis., appoints John P Conde advertising and sales promotion manager. He will be located at 204 W Washington St, Milwaukee, Wis.

R M Brown rejoins the sales organization of **Bristol Co.** He will be stationed at Baltimore, Md.

Morse Chain Co, division of Borg-Warner Corp has made J Nall Candler administrative assistant to F M Hawley, president and general manager.

J D Fletcher resigns as vice-president of **Caterpillar Tractor Co,** but will continue to serve the company as a consultant. Fletcher will be located at the San Leandro, Calif. plant. H J Hunkele Jr is now assistant manager of sales engineering div in Peoria, Ill.

Baldwin Locomotive Works, Eddystone, Pa., announces following changes in its sales organization: E R Wisner becomes manager locomotive dept; E F Sheehan, manager, renewal parts dept; Robert S Oberlander, manager, diesel engine dept; M L Hall, manager, testing equipment dept; George F Walsh, sales promotion manager for all product groups; Andrew Liston, manager, hydraulic turbine and marine products dept; J V Breen, manager, order service section; and R Zerewat, manager, market research and statistics.

Kenneth R Beardslee has been named president of **Carboloy Co,** Detroit, Mich., to succeed the late Walter G Robbins. Eugene F Wambold has been made executive vice-president in charge of manufacturing, engineering, employee and community relations, and purchasing. Beardslee and Wambold have also been elected to the board of directors. In addition, J M Bertotti has become assistant sales manager.

Airtemp Div, Chrysler Corp, Dayton, Ohio, announces election of Carl E Buchholzer as vice-president and member of the board of directors.

Jesse W Eakins has been selected as eastern Michigan and the Toledo, Ohio metropolitan area sales representative of **Centric Clutch Co.** His address is 3105 W Grand Blvd, Detroit, Mich.

C A Dunham has chosen R J Clark Equipment Co, Clearwater, Fla., to handle sale and servicing of Dunham heating products in Florida.

J R Carlson joins engineering sales staff of **Cuno Engrg Corp,** Meriden, Conn.

Merger of **C H Dutton Co,** Kalamazoo, Mich., and **Hapman Conveyors Inc,** Detroit, under the new name of Hapman-Dutton Co has been announced. In the reorganization, Henry W Hapman has

DRAVO CORPORATION

POWER DEPARTMENT

Let us be your Construction Department

ENGINEERING CONSTRUCTORS

PHILADELPHIA ELECTRIC COMPANY'S 180,000 kw power station at Barbadoes Island, Norristown, Pennsylvania. The additional facilities recently constructed by the Power Department of Dravo Corporation more than triple the capacity of the original station.

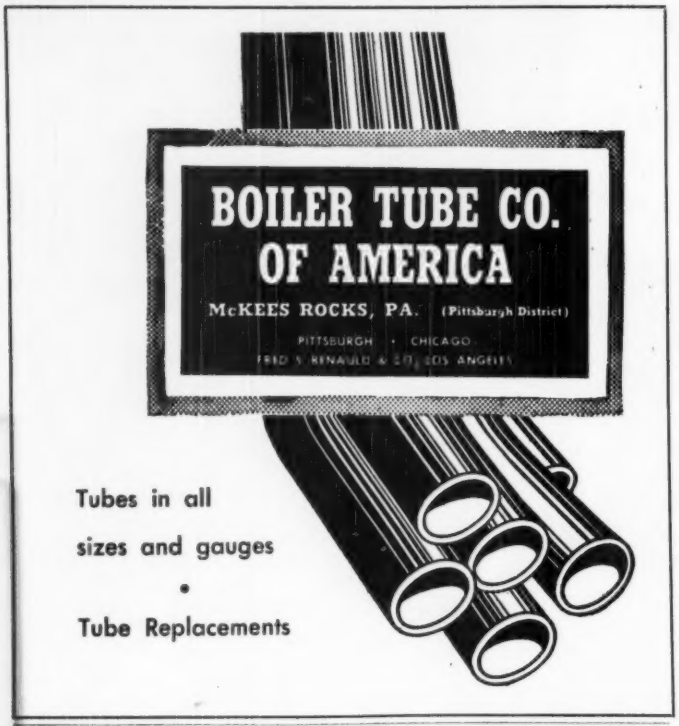
DRAVO
CORPORATION

DRAVO BUILDING, PITTSBURGH 22, PA.

DRAVO

Engineering constructors of power plants, boiler plants, central stations, compressor stations, water pumping stations. Fabricators and erectors of power piping. Machinery installation. Power and boiler plant equipment.

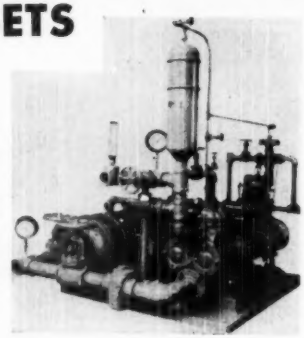
PITTSBURGH · PHILADELPHIA · CLEVELAND · NEW YORK · DETROIT

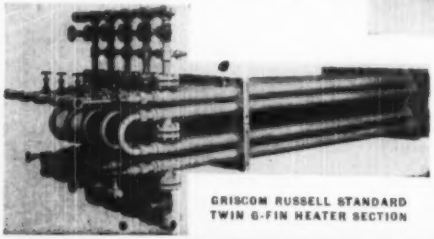


LOCKETT FUEL OIL PUMPING and HEATING SETS

Custom Built

For almost a half century, Lockett has been supplying, to fit individual needs, efficient, standard and custom-built, Fuel Oil Pumping and Heating Sets, for mechanical and steam atomizing oil burners. Combinations of various types of pumps are available. Each pump is suitable for the full rated capacity of the unit; and one heater section is a spare. Lockett supplies everything, complete. Inquiries are invited. *Ask for Bulletin AML-40-2.*





GRISCOM RUSSELL STANDARD TWIN G-FIN HEATER SECTION

The efficient, compact unit illustrated above, consists of one Worthington Duplex Steam Pump and one Electric-driven Pump.

Heaters for Lockett Pumping and Heating Sets consist of the proper number of G-Fin Sections mounted in parallel, or series, with one unit as a spare. *Ask for Bulletin AML-40-4.*

A. M. LOCKETT & COMPANY, LTD.
Contracting Mechanical Engineers
NEW ORLEANS - HOUSTON - DALLAS - GALVESTON

been elected president and general manager. Robert J Brown has been elected vice-president, assistant general manager and treasurer. Both lines of products will be manufactured in the Dutton plant in Kalamazoo.

Election of Paul H Davey Jr as vice-president in charge of production of **Davey Compressor Co,** Kent, Ohio, has been announced.

Instrument Div, **Allen B Du Mont Laboratories Inc,** has chosen Ron Merritt, 217 Ninth Ave North, Seattle, Wash., as field sales agent. He will be in charge of the Northwestern territory comprising the states of Washington, Oregon, Montana, and northern section of Idaho.

F F Roehll is now national sales manager for **Eutectic Welding Alloys Corp,** New York City.

The following are chosen sales agents for **Dampney Co of America:** Boiler Supply Co, 440 Chestnut St, Nashville, will cover central Tennessee. R E Mundy Co, 1520 Cleveland, S W, Roanoke, Va., will handle central Virginia and southern West Virginia. In Mexico, the distributor is Consultores y Abastecedores Industriales, SA, Dolores 17-301, Mexico, D. F.

Fairbanks, Morse & Co has assigned Leonard J Maguire to its scale plant in St. Johnsbury, Vt., as works manager.

A P Green Fire Brick Co has promoted C J Yaeger to district sales manager and sales engineer for the Texas territory. His office will be in Houston.

Ponsford-Moos Equip Co, 516 San Francisco St, El Paso, Texas, has been made exclusive sales representative in Panama, Costa Rica, Nicaragua, El Salvador, Honduras and British Honduras for **Eriez Mfg Co.**

V W Farris announces formation of a company to purchase the Edison Stacon regulating valve div from Thomas A Edison Inc (Instrument Div). The new company will be known as **Farris Stacon Corp,** with the main office and plant located in Palisades Park, N. J.

General Refractories Co, Philadelphia, names Harry T Graham general sales manager. S S Furst is promoted to assistant to vice-president in charge of sales.

Charles T Button becomes director of sales for **Holtzer-Cabot** div of National Pneumatic Co, Boston, Mass.

Lincoln Electric Co, Cleveland, Ohio, appoints A W Sawyer assistant to the vice-president.

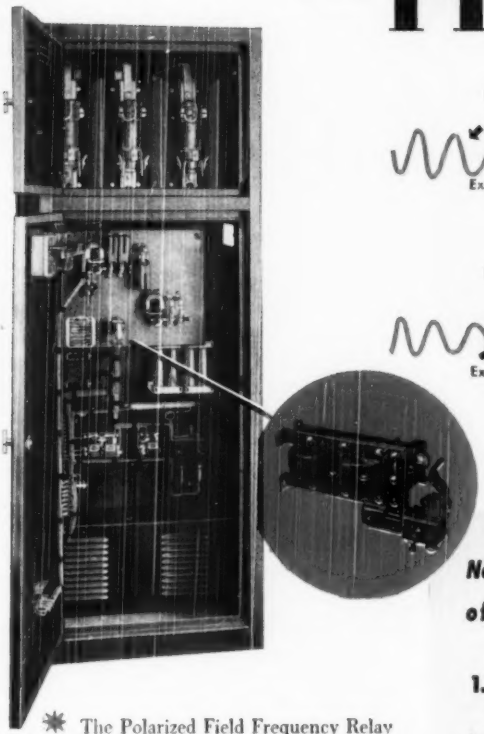
Mills Engrg Co, 10 High St, Boston, Mass., will represent **American Well Works** in the states of Maine, New Hampshire, Ver-

Wheelco Instrument Co has opened a sales office in Grand Rapids, Mich., which will cover the state of Michigan, with the exception of Detroit. R P Campbell will be in charge as assistant district manager. The

HERE'S HOW YOU GET

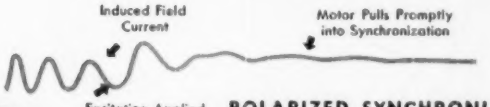
Perfect Motor Synchronizing

WITH **PFFR** *



INCORRECT SYNCHRONIZING

Excitation applied at unfavorable point, with resulting high surges of current and reversals of torque before synchronizing.



POLARIZED SYNCHRONIZING

Excitation applied at point that gives best synchronizing, with minimum current and maximum torque.

* The Polarized Field Frequency Relay Control System, an original E-M development perfected over many years, still continues to be accepted by the most competent engineers as the best control on the market. The reasons are that this system is continuously sensitive to motor speed and rotor position . . . applies excitation at just the right instant for the smoothest, most powerful synchronization on starting . . . provides for prompt resynchronization should the motor pull out of step from voltage dips or overloads. No other method can do these things . . . provide this simple, correct and wholly reliable method of synchronization. Polarized Field Frequency Relay is a key part of the Motor Control E-M has developed.

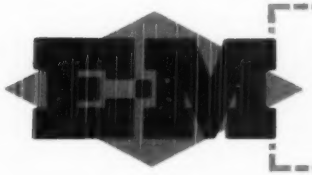
ELECTRIC MACHINERY MFG. CO.
MINNEAPOLIS 13, MINNESOTA

***Noteworthy are these other advantages of* E-M MOTOR CONTROL**

★ ★ ★

1. **Short circuit protection—with current-limiting and power fuses.**
2. **Motor isolating disconnects—fuses that can be swung open.**
3. **Complete motor protection—coordinated, pre-engineered control.**
4. **Safety for operators—metal enclosed units.**
5. **Adaptability for group lineup—sturdy, attractive, free standing and easily installed units.**

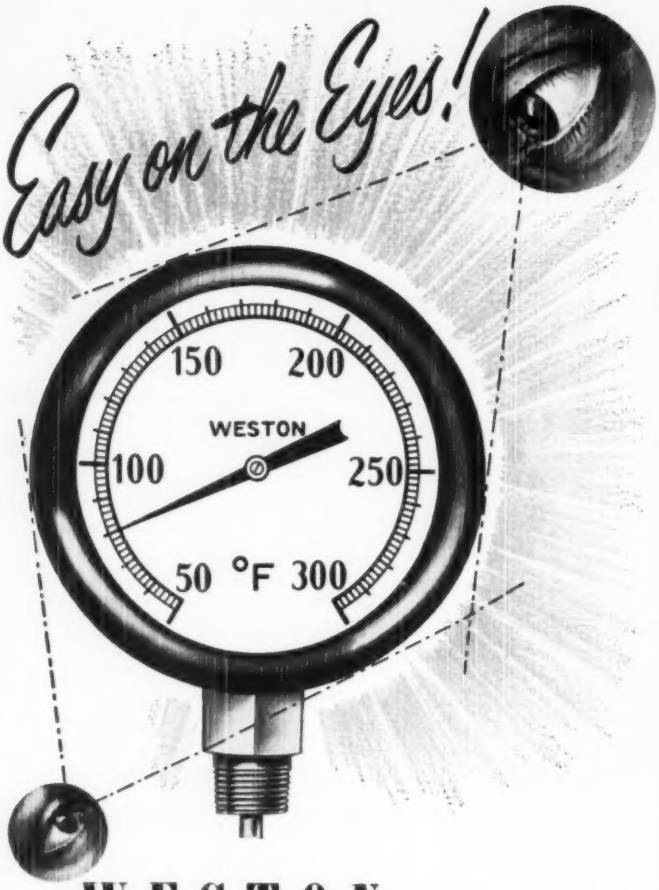
Call on your E-M field engineers for full details or write to us today for Bulletin 192.



SYNCHRONOUS MOTOR CONTROL

COMPLETE PROTECTION • CORRECT SYNCHRONIZING

3100-TPA-2076



WESTON *All-Metal* THERMOMETERS

Easy on the eyes—that's just one feature that makes easy-to-read Weston Thermometers the answer to your temperature measuring problem.

Easy on the mind—you can relax when Weston All-Metal Thermometers are supervising important industrial processes.

Easy on the budget, too—Weston All-Metal Thermometers deliver dependable, faithful service . . . year in, year out.

Be sure to check your Weston Representative—or write Weston Electrical Instrument Corporation, 679 Frelinghuysen Avenue, Newark 5, New Jersey . . . manufacturers of Weston and Tagliabue instruments.

WESTON *Instruments*

new office will operate under supervision of the Detroit district office. Don C Walley has been made S. Louis, Mo. district manager. Warren F Paetz has taken over Walley's former territory of Central Illinois and Iowa and will be located at Wheelco's Chicago western div office. Samuel M McDevitt has been tranferred to New York eastern div office and Edward F O'Brien has replaced him in the Philadelphia district office. Tom Mitchell has been transferred to Boston district office.

Frank Frable, 122 S Michigan Ave, Chicago, Ill., is chosen sales representative for **Nickel Cadmium Battery Corp.** Frable will specialize in sales of Nicad storage batteries to electrical utilities in the territories he covers in Illinois, Indiana, Wisconsin and Iowa.

Penn Industrial Corp, Philadelphia, announces appointment of James W Bennett as general manager.

Charles H Goddard assumes responsibility for national accounts sales in the lighting div of **Sylvania Electric Products Inc.** He will also continue in his present capacity as manager of utility sales.

Turco Products Inc transfers J Charters to northern California sales district, with headquarters in San Francisco. He replaces the late Al Martinez as district manager. Chris Williams succeeds Charters as district sales manager in Houston, Texas.

Nils Walter Swenson assumes duties of assistant manager of branch sales for the mechanical goods div, **U S Rubber Co** in New York. F D Baker Co, 713 S 10th St, Milwaukee, is made distributor in southern Wisconsin for the firm's complete line of industrial rubber products.

Standard Transformer Co has chosen E C Fones Jr, 3104 Raymond St, Raleigh, N. C., as its representative for the states of North and South Carolina. John G Gaines Co, 2201 Grand Ave, Kansas City, Mo., will handle state of Kansas, and western Missouri.

W C Schofield is named assistant sales manager by **Ward Leonard Electric Co,** Mount Vernon, N. Y.

York Corp, York, Pa., promotes Ralph L Beach to assistant general service manager to assist Roger H Dowling.

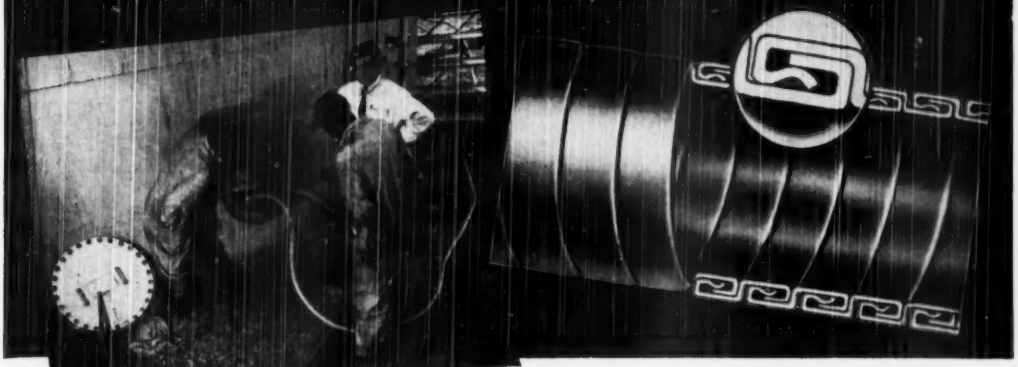
Mutual Boiler & Machy Insurance Co has opened a new office in Baltimore, Md., at 2322 N Charles St, staffed by W J Withers and Edward Daughtry. Territory includes Maryland, eastern Pennsylvania, Washington, D. C., and southern Delaware.

Bert W Whitehurst has rejoined **Stone & Webster Engrg Corp,** Boston, Mass., as industrial engineer.

Burns & Roe Inc, New York City, has appointed Frederick C Schlemmer manager of construction.

Z E Merril resigns as president of **Mountain States Power Co** and becomes chair-

Utility hose of 101 uses around the plant or in the field . . .



Top photo—CMH REX-TUBE Type RT-15 being used to steam out a storage tank. Middle photo—CMH REX-TUBE Type RT-15 used as a gas connection for a furnace. Bottom photo—CMH REX-TUBE Type RT-15 used for unloading a tank car.

CMH REX-TUBE Interlocked Flexible Metal Hose

IF you convey steam, tar, asphalt, vegetable oils, hydrocarbons or similar substances between relatively movable parts, CMH REX-TUBE Type RT-15 flexible metal hose does the job economically and dependably. REX-TUBE Type RT-15 combines the long life and durability of metal with an exceptionally high degree of flexibility. Further, it is non-aging, non-contaminating and non-collapsible.

REX-TUBE Type RT-15 is of fully interlocked design in bronze or steel with asbestos packing. (See cross-section above.) Suitable for temperatures up to 600° F; pressures to 500 psi. Sizes range from $\frac{1}{2}$" I.D. through 12" I.D.

Data sheets including specifications are available on request. Write, today!

Flexon identifies CMH products that have served industry for over 48 years.

CHICAGO METAL HOSE Corporation

1301 S. Third Avenue • Maywood, Illinois • Plants at Maywood, Elgin and Rock Falls, Ill.
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ONE DEPENDABLE SOURCE

for every flexible metal hose requirement

Convoluted and Corrugated Flexible Metal Hose in a Variety of Metals • Expansion Joints for Piping Systems
Stainless Steel and Brass Bellows • Flexible Metal Conduit and Armor • Assemblies of These Components

Discarding condensate because of OIL?

If you are throwing away valuable condensate rather than risk its return to the boiler because of oil contamination, filtration with Sorbo-Cel may be the answer to your problem.

Low in Cost

This specially processed diatomaceous silica powder provides a simple, economical method of removing emulsified oil from water and thereby obtaining an oil-free condensate for boiler feed or other use. Total cost ranges from only 1¢ to 3¢ per 1000 gallons of water filtered.

How it works

A small amount of Sorbo-Cel is simply mixed with the oil-contaminated water, which is then pumped through a pressure filter. Here the oil globules are removed by the specially treated Sorbo-Cel particles, and both are retained upon the filter screen. The filtered water alone passes through.

Does complete job

Sorbo-Cel does a complete job of oil removal. In addition, it removes other suspended matter such as rust, scale, clay and precipitates. And its action is so efficient that large volumes of water can be filtered in a relatively short time.

A bulletin that gives further facts about this low-cost way to remove oil from water is available on request. Just use the coupon below.

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Johns-Manville

SORBO-CEL

Johns-Manville
Box 290, New York 16, N. Y.
Send me free bulletin giving advantages of Sorbo-Cel filtration.

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Company_____

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POW 9

man of the board. A W Trimble succeeds Merril as president.

Georgia Power & Light Co has elected John W Lastinger president to succeed J F Bailey, who has resigned. C W Warner has been elected vice-president and a director.

Stoker Manufacturers Assn has elected the following officers for the ensuing year: *President*—C T Burg, president, Iron Fireman Corp, Cleveland, Ohio; *vice-president*—L C Dubs, president and general manager, Canton Stoker Corp, Canton, Ohio; *secretary-treasurer*—T A Crawford, general manager, Timken Silent Automatic Div, Timken-Detroit Axle Co, Detroit, Mich.; *executive secretary*—Marc G Bluth, Chicago.

Executive board of **National District Heating Assn** for ensuing year consists of the following: *President*—George H Tuttle, Detroit Edison Co, Detroit, Mich.; *first vice-president*—Alfred T Veness, Rochester Gas & Electric Corp, Rochester, N. Y.; *second vice-president*—Percy A Hyde, Ohio Edison Co, Akron, Ohio; *third vice-president*—Charles W Deeg, Philadelphia Electric Co, Philadelphia, Pa; *secretary-treasurer*—John F Collins Jr, NDHA, Pittsburgh, Pa.

National Assn of Fan Manufacturers Inc has elected the following officers for the ensuing year: *President*—E E Trickler, vice-president, New York Blower Co, Chicago, Ill.; *vice-president*—Edgar F Wendt, president, Buffalo Forge Co, Buffalo, N. Y.; *secretary-treasurer*—L O Monroe.

OBITUARIES

Bruce A Irwin, 48, vice-president and general manager of Hammel-Dahl Co, Providence, R. I., died June 14 as a result of an automobile accident.

William Nelson Weinman, 82, president and founder of Weinman Pump Mfg Co, Columbus, Ohio, died June 17 after a long illness.

Wilbur H Stacy, work comptroller for Worthington Pump & Machy Corp, Harrison, N. J., died June 23 after a long illness.

Herbert E Godfrey, 69, president of Richarson Scale Co, Clifton, N. J., died June 25.

Leonard H Birkett, 59, general sales manager of Combustion Engrg Corp, Ltd, (Canada), died June 27 at his home in Montreal.

Herbert E Hollberg, 51, vice-president of Proportioners Inc, Providence, R. I., died suddenly July 1 at his home in Cranston, R. I.

Arthur Ludt, 56, a contract engineer for Combustion Engrg—Superheater Inc, New York City, died July 12.

Harry F Idzkowsky, 65, safety director of Mine Safety Appliances Co, Pittsburgh, Pa., died Juy 14.

Arthur H Timmerman, 79, recently retired vice-president of Wagner Electric Corp, died July 18 while on a vacation trip in Dallas, Texas.

Get ready for Winter!

INSTALL

TODD BURNERS

-GAS OR OIL

Now's the time to prepare for cold weather! Cut your power costs . . . modernization saves up to 10% on your fuel and maintenance bills. Let skilled Todd specialists engineer your boiler plant for maximum economy — either by modernizing obsolete equipment or providing a new and efficient installation.

Oil Burners
Gas Burners
Combination Oil and Gas Burners

COMBUSTION EQUIPMENT DIVISION

TODD SHIPYARDS CORPORATION

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Your nearby TUBE TURNS *distributor can serve you right from stock. Call him for prompt delivery.*

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He'll steal your Plants!
Btu's are "Shop-Lifters" if given half a chance. When they wander from the straight and narrow, they push operating costs sky-high, drive efficiency and employee morale way down . . . and walk off with much of your profit.
Keep Btu's in line by protecting your equipment with CAREY Industrial Insulation. When you do, Btu's will work like beavers —you'll save fuel, increase efficiency, too!
And to keep Btu's on the job at high temperatures—here's a new, improved insulation
Carey Tempchek
a specialized material with a temperature range up to 1500 F., low K-factor, rugged strength, excellent Handleability—
It's a combination of outstanding qualities
Ask about it!
CAREY Makes The Complete Line
85% Magnesia—Industrial Rock Wool
Asbestos—Pipe Coverings—Sheets—
Blocks—Batts—Papers—Air-Cell
Write for your free copy of "Heat Insulation For Industry." Address your request to Dept. PO-9, The Philip Carey Manufacturing Company, Cincinnati 15, Ohio. In Canada: The Philip Carey Company, Ltd., 1557 MacKay Street, Montreal 25, P.Q.
Call your Carey representative today. He's a trained expert who is eager to serve you.
Carey

POWER NEWS

(*Continued from page* 136)

consist either of natural uranium, uranium enriched in U_{235}, or other nuclear fuels such as plutonium (Pu_{239}) or U_{233}. Enriched reactors would have certain advantages when used for power units, as in ship propulsion. Natural uranium reactors, which would "burn" only about 1% of the uranium, could be used without refueling during the working life of the power unit but have only a small excess of reactivity, making neutron economy essential.

3. *Intermediate* reactors, which could also use the breeding principle, might be a third line of attack.

Heat-Transfer Rates. These will be high for fast reactors, Cockcroft said, and can probably only be handled by liquid-metal coolants. Davidson pointed out that so far adequate data are not available for molten metals and several other substances yet to be considered.

Neutron Economy. Breeding reactors, as mentioned, have to be designed for maximum economy of neutrons, since wasteful absorption or loss reduces the gain factor. Natural-uranium reactors have very little surplus of neutrons above those needed for continued fission reaction. Hence reactor design must go hand-in-hand with development of metals having low absorption factors for the fuel-element sheaths, coolant and coolant-circulating tubes.

Davidson dwelt at length on this aspect, and mentioned that to limit "poisoning" of the reactor (absorption of neutrons by fission products) it is necessary to remove the "ashes"—that is, the fission products—from time to time or, better, continuously. "As these will exist in intimate mixture with the uranium," he wrote, "their removal requires taking the whole mixture out of the reactor and subjecting it to complex chemical and physical treatments to separate the waste from the unspent uranium, which in a large-scale power reactor would be too valuable to throw away. . . ."

Other major problems are: (1) developing moderator and structure materials of sufficient stability to insure long operating life (2) chemical processing of nuclear fuel, and (3) disposal of radioactive wastes.

As to fuel costs, Cockcroft added in the discussion that this was problematical at present: "until we have a pilot-plant operating we don't have any basis for estimating costs." As to price and availability of adequate supplies of uranium, a point raised by several discussers, Sir John stated "there is no reason to be unduly pessimistic about these, so long as our present research into up-grading low-grade ores shows such promising potentialities."

The Reliance Safety Team

Warns you of low or high boiler water

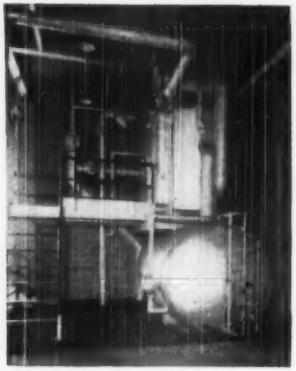
Prevents many a water level accident

This team works for thousands of plants like yours. It double checks boiler water levels—helps you achieve more efficient operation, lower power cost, greater safety. The sensitive float-operated mechanism in the Alarm Water Column sounds a last-resort warning (see whistle) when water approaches low or high danger points. But for minute-by-minute scanning by operators, EYE-HYE beams its bright picture of true water level condition from a convenient eye-level position. It's the original remote reading gage—all-hydrostatic, simple, sure. It pays you to have the Reliance Safety Team for adequate boiler water level supervision. Write for details—or ask your Reliance Representative.

The Reliance Gauge Column Company • 5902 Carnegie Ave., Cleveland 3, Ohio

Reliance Boiler Safety Devices since 1884

HOPPES FEEDWATER HEATERS



Deaerating feedwater heater serves as condensation return point for trapped and pumped returns from heating system

DEAERATING:
For medium and high pressure Central Stations; modern Industrial and Process Plants; Steam Heating Plants and all Modern Power Plants which have boilers operating at medium and high pressures.

NON-DEAERATING:
For Laundries; small Industrial Plants; Institutions and all smaller Power Plants where boilers are operated at lower pressures and where economy of investment is desired.

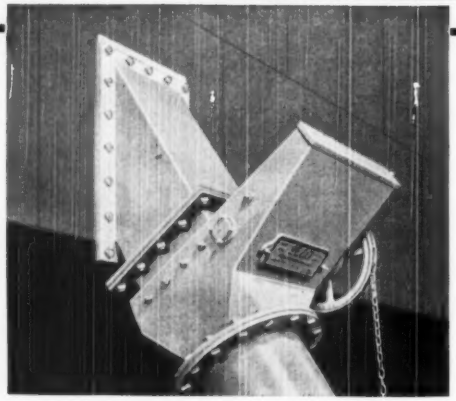
PLATE TYPE:
Deaerating heaters of plate type are designed for capacities up to 85,000 pounds per hour. Non-deaerating heaters include capacities up to 120,000 pounds per hour.

CAST IRON:
(Integral Unit) Designed to meet space limitations, their outlet capacities range from 3,000 pounds per hour to 15,000 pounds per hour.

STEEL TYPES:
These heaters are more diversified and are obtainable as follows—Vertical or Horizontal heaters with integral storage; vertical heaters mounted on vertical storage tanks; vertical heaters mounted on horizontal storage tanks and horizontal heaters mounted on horizontal storage tanks.

ENGINEERING SERVICE:
Hoppes engineers work with you to assure that your individual and specific requirements are provided for in full. Let's talk it over—get the economy angle.

HOPPES MANUFACTURING CO., Inc.
Established in 1881
SPRINGFIELD, OHIO



S-E-CO. COAL VALVES can be made for installation in an inclined position, as shown in photograph. In some plants if coal valves are installed in this position, a considerable saving in headroom results. These valves are equipped with a disc brake so that they are not self-closing.

Your inquiry would be appreciated.
STOCK EQUIPMENT COMPANY
715P Hanna Building ★ Cleveland 15, Ohio

(*Continued from page* 162)

U-tube should be connected into air-inlet pipe on engine side of filter. It should be as close to the filter as possible.

Measurement of pressure drop through air filters is especially necessary on turbocharged engines. This avoids troubles from (1) fouling of compressor blading and (2) excessive supercharger speed because of reduced air flow.

Gages to show pressure of air discharged from superchargers or scavenging blowers are generally furnished by the engine builder. If not supplied they should be installed to check blower performance.

Manually adjusted butterfly valves sometimes are installed in the line between a motor-driven centrifugal scavenging blower and a two-cycle engine, to throttle air flow when air is cold and load is light. This avoids higher fuel consumption and danger of overloading blower motor.

Technical Briefs

(*Continued from page* 134)

to 1200 F. Many have severe drawbacks, some definite advantages.

The use of heated metals and gases such as mercury and combustion gases have enjoyed some success. But full satisfaction just couldn't be had. Mercury is too expensive, dangerously poisonous, and easily forms an unwanted chemical compound when used in the environment of steel and air.

Air and combustion gas at high temperatures require large ductwork and large circulated volumes if any sizable heat transfer is to take place.

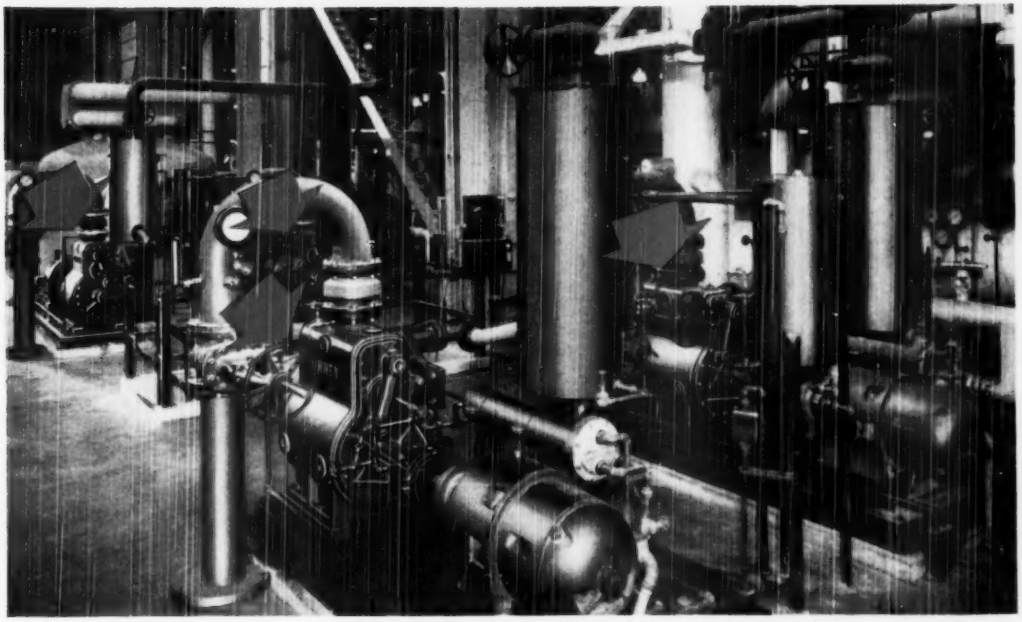
Steam heating works only up to the saturated temperature level. There are considerable losses due principally to condensate flashing. The high pressure requirements discourage steam for process heating above 250 F.

Chemical vapors have been used to some extent for this service. In general, though, it is less satisfactory than the use of a circulating fluid, either water under pressure or a chemical with a high boiling point.

From this point on the author discusses various liquid heat transfer agents available, their application to high-temperature processing and equipment designed for such service. *ASME paper. No. 50-SA-22.*

Smoke Prevention

ELECTROSTATIC COLLECTION OF FLY-ASH. *by H J White, director of research; I. M Roberts, manager of development and research; C W Hedberg, director of engineering; Research Corp.* The magnitude of the flyash problem is indicated by the quantity of pulverized coal burned by utilities. In 1948 it was



No dollars are being thrown away at Potomac TODAY!

Things have changed since the days when George Washington threw a dollar across the Potomac River! Today, the Potomac Electric Power Co. has mastered the technique of keeping dollars on their own side of the river . . . and Kinney Rotary Vacuum Pumps are helping to turn the trick.

Here at the recently completed Potomac River Generating Station, these Kinney Rotary Vacuum Pumps maintain the condenser vacuum conditions required for efficient steam generation. As in so many other modern power plants of the 850 psi, 925°F. class and above, these mechanical vacuum pumps are employed because they contribute important economies. Kinney Pumps conserve manpower costs. Like other motor-driven auxiliaries, these pumps can be controlled from the central control room. They take care of the entire condenser vacuum problem "single-handed". They avoid the maintenance and supervisory costs that are constant "plant headaches" with steam-jet ejectors. They simplify piping layouts and they reduce costly, high-pressure piping to the barest minimum—*a single steam line from boiler to turbine.* They remove contaminating gases along with the air-vapor mixture, thus preventing the concentration of corrosive carbon dioxide, ammonia, etc., in the boiler water.

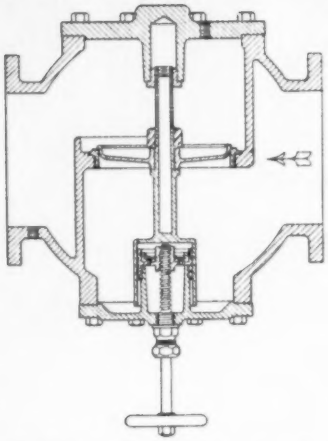
If you are looking for these same dollar-saving advantages, get in touch with your nearest Kinney engineer . . . or write for "Use of Mechanical Vacuum Pumps in Central Station Operation"—a detailed engineering report including installation diagrams. Also ask for Kinney Vacuum Pump Bulletin V45.

Kinney Manufacturing Company, 3532 Washington St., Boston 30, Mass. Representatives in New York, Chicago, Cleveland, Houston, New Orleans, Philadelphia, Los Angeles, San Francisco, Seattle.

Foreign Representatives: General Engineering Co. (Radcliffe) Ltd., Station Works, Bury Road, Radcliffe, Lancashire, England . . . Horrocks, Roxburgh Pty., Ltd., Melbourne, C. I. Australia . . . W. S. Thomas & Taylor Pty., Ltd., Johannesburg, Union of South Africa . . . Novelectric, Ltd., Zurich, Switzerland . . . C.I.R.E., Piazza Cavour 25, Rome, Italy.

KINNEY
Vacuum Pumps

CONDENSER RELIEF VALVES



A DAVIS Specialty!

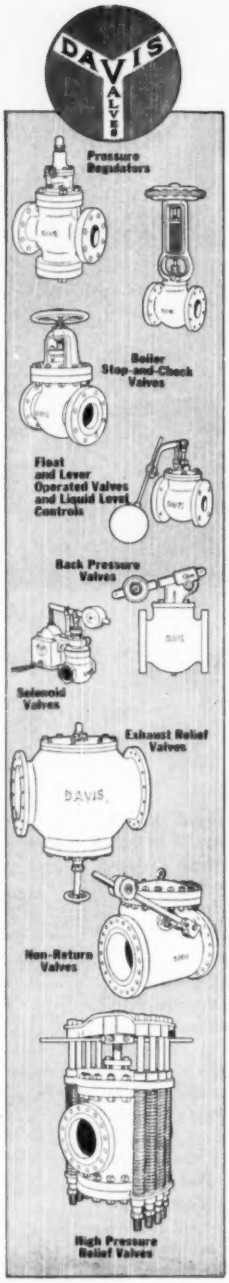
DAVIS specializes in building atmospheric exhaust relief valves to meet the modern needs of power plants for protective equipment. The Davis No. 110 Relief Valve, shown in cross-section above, is one of the the several widely-used Davis designs that give engineers what they want for condenser protection.

No. 110 features a quick opening and cushioned closing action. The bronze-to-bronze-contact valve is water-sealed through inlet and overflow pipe connections in the body. It holds tight under high vacuum to prevent air infiltration into the condenser and relieves to atmosphere at a fraction of a pound pressure when for any reason the vacuum is lost. Shown here with hand lift at bottom, it is also available with hydraulic lift.

The Davis line of exhaust relief valves is complete. Sizes from 6" to 48". Horizontal, vertical, or angle body patterns. For detailed information, ask for Bulletin No. 101A.

No. 110 Exhaust Relief Valve

Left.—Davis has brought the atmospheric relief valve to a high point of perfection, with a combination of engineering features not found elsewhere.



DAVIS REGULATOR CO.

Representatives in All Principal Cities

2540 S. WASHTENAW AVE., CHICAGO 8, ILL.

65,000,000 tons. On the reasonable basis of an average ash content corresponding to 10%, quantity of flyash emitted would be about 5,000,000 to 6,000,000 tons annually.

To bring the example down to a typical plant, a large modern boiler producing 900,000 lb of steam per hr puts out about 450,000 cfm at 300 to 400 F. With a flyash concentration of two grains per cu ft, which is not uncommon, dust emission reaches 130 lb per minute or 92 tons per day. Treating 450,000 cfm of hot flue gas and disposing of about 92 tons of flyash are sizable jobs.

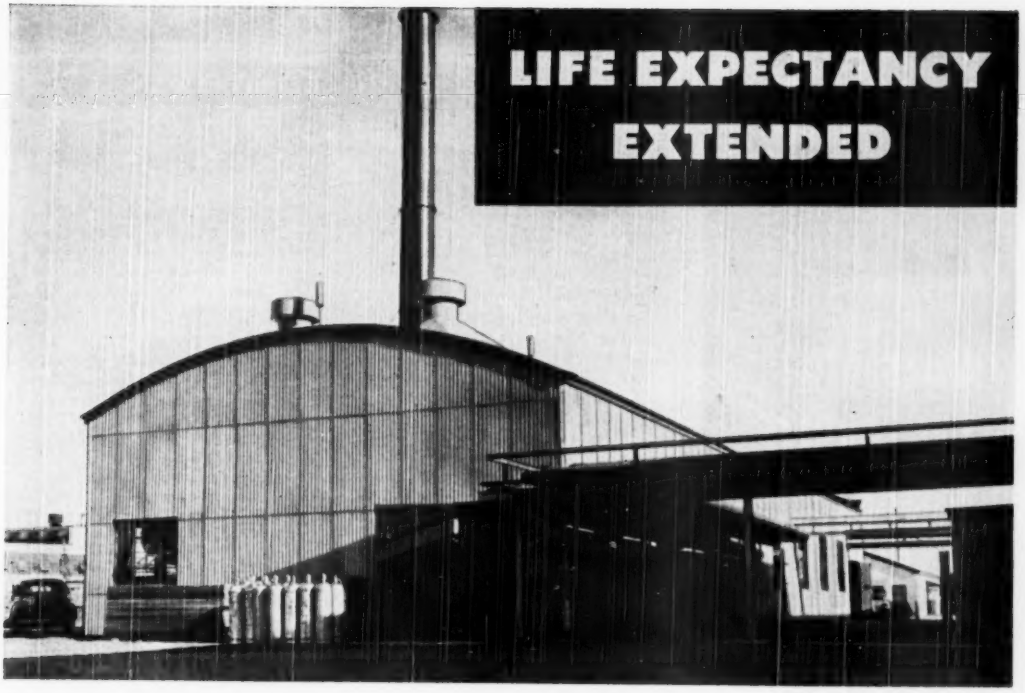
Electrostatic precipitators have enjoyed a wide application in this field. In some instances, collection efficiencies of 90% and over have been recorded on a continuous basis.

This discussion includes current status of electrostatic flyash precipitation and also apparent trends. Significant properties of flyash as they affect design, physical basis of electrostatic precipitators, and practical design and application engineering of these devices come in for treatment. The more important problems are reviewed and indicated solutions are given. *ASME paper. No. 50-SA-39.*

MECHANICAL DUST COLLECTORS: THE PROBLEM AND APPLICATION, *by John T Doyle, Thermix Corp.* Within the last decade there has been extensive progress in mechanical dust precipitation. Much of it has been due to public concern regarding air pollution.

At present there are several national bodies attempting to write a sample ordinance that can be adopted with reasonable assurance of acceptance by all communities. Among the better known are the American Society of Mechanical Engineers and the Smoke Prevention Association of America. Each attacks the problem on the basis of emissions, but with somewhat different approaches. Yet both propose emission standards that can be enforced. And it is economically possible to obtain equipment needed for compliance.

For a dust-collector manufacturer to quote intelligently on any job he needs to know emission standards, boiler and boiler-plant arrangements. Here are the facts in order of importance that help make a comprehensive proposal possible. Code compliance, local plant nuisance, product contamination, fan erosion, plant layout or sketch showing space available for collection equipment, combustion data, including lb of steam per hr, lb of gas per hr or cfm, temperature, altitude of plant above sea level, stack-gas dust loadings in lb per 1000 lb of gas or grains per cu ft, analysis of dust (elutriation preferred or submit sample), type of firing, type and source of coal, available draft for



by K&M "Century"® ASBESTOS CORRUGATED

Compressor Room of the Birds Eye-Snider Plant at Walla Walla, Washington, is sided with K&M "Century" Asbestos Corrugated Sheets.

The sturdy "clean build" of these compressor plant walls is one sign they'll live long. They're K&M "Century" Asbestos Corrugated, the material you see on more and more industrial and commercial buildings whose owners have made sure of lasting good looks and economy.

K&M Corrugated saves from the start by simplifying and speeding erection. Cutting, drilling, fitting and anchoring are easily done, with every assurance of trim, durable enclosure. What's more, K&M Asbestos Corrugated Sheets—*stay put*. They don't give in to weather effects and fire hazard, nor to rust, rot, rodents and termites. Thus long-term freedom from maintenance goes right along with the initial economy of using K&M "Century" Asbestos Corrugated for siding and for roofs, too.

Whatever your building plans, see how much this adaptable modern material can save you. Write us for full data and the name of your nearest K&M Distributor.

Even scaffolds and extra labor are eliminated when "TOP-SIDE"* fasteners are used. They are made for use with steel members of any type, on sides and roofs.

* H. & B. Enterprise Corp.

Nature made Asbestos... Keasbey & Mattison has made it serve mankind since 1873

KEASBEY & MATTISON

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In Canada — ATLAS ASBESTOS CO., LTD., MONTREAL, TORONTO, WINNIPEG and VANCOUVER

collector, draft loss, desired hopper storage. *ASME paper. No. 50-SA-37.*

CORRELATION OF SOLIDS CONTENT IN GAS WITH PHOTOELECTRIC SMOKE-METER READINGS, *by W F Stoecker, research engineer, American Locomotive Co.* Common method of smoke measurement is by a visual comparison between smoke issuing from a stack and a set of Ringelmann charts. Convenience is certainly the chief advantage of the Ringelmann method. What's more, an inspector can use the charts with reasonable success after only a brief introduction.

But there are so many inadequacies that the practice is always open to criticism. The system is subjective and purely arbitrary so that two observers often fail to arrive at the same reading. Such things as intensity of sunlight, wind velocity, and other atmospheric conditions affect observation. No inspection can be made at night. There are many other criticisms that can be made.

The most direct approach to finding weight of solids leaving a stack is to remove and weigh particles from a measured amount of gas. Then solids are expressed in weight per unit volume at a specified temperature. This was the method used for these tests although it is not always practical for field checks.

A previous text entitled *A Quantitative Measurement of Smoke*, by R J Pierson (Illinois Geological Survey, Report of Investigations 41, 113 pp, 1936) covered relationship of smoke concentration to gas opacity. This test was to relate opacity of gas to total solids suspended in it.

Tests indicated a definite correlation between photoelectric-cell readings and weight concentration of smoke as determined by a filtration process. There are certain factors, though, which must be considered in converting from a photoelectric cell determination to a basis of weight per unit volume. They are: (1) Temperature of gases at the sampling point. (2) Thickness of the smoke column. All tests were run with stacks 9 in. and under so additional data is needed for large-diameter stacks (3) Percentage of ash in the solid particles. For a given smoke loading in the stack the presence of flyash causes a reduction in light absorbed. For precise measurements each installation would have to be calibrated because of fuel variations and firing methods. *ASME paper. No. 50-SA-16.*

Air Conditioning

OPERATING AND MAINTENANCE EXPERIENCE OF 150-TON STEAM-ABSORPTION REFRIGERATING UNIT, *by R A Lammers, Consolidated Edison Co of N. Y.* Since 1947 the author's company has run a

Monsanto SANTOBRITE controls slime and algae in cooling towers

Slime and algae, enemies of good cooling tower operation, are kept under control by Santobrite (Monsanto's sodium pentachlorophenate, technical). Santobrite is economical...easy to use...efficient.

If slime and algae cause trouble in your cooling towers, it will pay you to read Monsanto Technical Bulletin No. O-15. For your copy, contact the nearest Monsanto Sales Office or write: MONSANTO CHEMICAL COMPANY, Desk A, 1763 South Second Street, St. Louis 4, Missouri.

Santobrite: Reg. U. S. Pat. Off.

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SERVING INDUSTRY... WHICH SERVES MANKIND

specify...

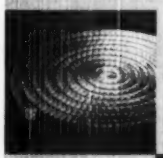
BELMONT FLAX PACKINGS

... for better sealing ... longer life. Don't gamble when making a packing replacement, make sure you select and GET Quality Flax Packings and the right type to fill your requirements.

To play safe, just say, "Give me Belmont," when you next order flax packings and you'll be reducing maintenance costs. Quality and special constructions are BELMONT features. Specialists select raw materials—engineers make the designs and expert craftsmen produce all the world-famous BELMONT styles right in the BELMONT plant.

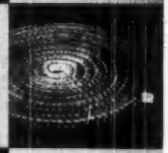
For better sealing ... longer life BELMONT PACKINGS — ask for them in the blue box with the orange colored trade mark. Distributors located in every large industrial center are ready to serve you. Or, if engineering help on your job is required, write direct.

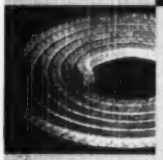
Catalog #40 is available



BELMONT 401X (Coil or Reel)—Best quality Line Flax Fibre of selected length and strength.

BELMONT 404 (Coil) — Pure flax fibre of next fibre length to Line Flax.





BELMONT 303 (Coil) —Line Flax of selected quality, with coarse and short fibres extracted. Treated with waterproof lubricant, and surface graphited.

There's a Belmont Packing for every service

THE BELMONT PACKING AND RUBBER CO.
Butler & Sepviva Sts.
Philadelphia 37, Pa.

4-K-2-A

Rings • Spirals • Coils • Reels
Spools • Sheets • Gaskets
Steam • Water • Oil • Gas • Air
Acids • Alkalies • Ammonia

Special Machine makes first 30" O.D. Corrugated Alloy Piping . . .

The first 30-inch O.D. chrome-moly corrugated piping was recently formed on the unique device shown here. Totaling some 90 feet over-all, eight pieces comprise the complete order. They are for the major part of the exhaust-steam line from a topping turbine in a main power station of a metropolitan utility in the East.

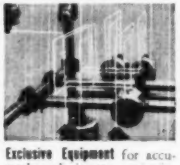
Beyond physical size itself, the major problem in fabrication was to preclude cracking, a defect much more apt to occur in forming chrome-moly than in working either carbon or carbon-moly steels. Through carefully controlled incremental heating and subsequent compression on a specially built machine, the corrugations were formed, giving the final corrugated piping five times the flexibility of plain piping.

Specific know-how in incremental heating was to a large degree responsible for the success of this operation . . . this and an extensive background in the fabrication of alloys. Over the years special alloy fabricating methods have been developed by Kellogg engineers, who have been entrusted with such recent innovations in power piping at the first HT-HP stainless steel installation and the fabrication of piping for the original 1050°F. station.

Knowledge of such special techniques is among the advantages utility companies gain when they specify M. W. Kellogg HT-HP power piping.

Special studies of unusual problems such as graphitization to assure long life and low maintenance.

Metallurgical research by recognized specialists who have made major contributions in this field.



Exclusive Equipment for accurately analyzing stresses in piping and providing unique data for critical installations.

Complete facilities for the fabrication of steel products from simple forgings to specially cast bi-metallic devices.

Top welding performance in shops and in the field by welders accustomed to working under X-Ray checks.

Quality control, devised by metallurgical experts, embracing forming, heat treating and non-destructive testing.

KELLOGG

To make preparation and process work

M. W. KELLOGG

piping and process equipment

Vessels
Exchangers
Condensers
Process Piping
Forged and Welded Fittings
Radial Brick Chimneys

★

The M. W. Kellogg Company, Inc. (Subsidiary of Pullman Incorporated)—Offices in New York, Jersey City, Buffalo, Los Angeles, Tulsa, Houston, Toronto, London and Paris

Fig. 3169 single stage, open impeller centrifugal

7 more sizes in this new Centrifugal Line

This new and extremely successful line of centrifugals is now available in 10 sizes. You can now take advantage of the efficiency of this new design to fill your pumping needs in a wide variety of applications.

APPLICATIONS

Goulds designed the Fig. 3169 especially for general water service, irrigation, Slurries, circulation, transfer and factory wastes. It also gives excellent service in air conditioning, plumbing, heating, processing and related applications.

ADVANTAGES

The most important advantage of these pumps is their efficient, modern design. Simple construction, light weight and compact size give you reasonable price and unusually good service over a long period of time.

CAPACITIES

Fig. 3169 is made in 10 sizes for both motor and belt drives. Capacities to 1000 G.P.M. with heads to 180 ft., depending on capacity.

For more information call or write Pump Headquarters or your nearest Goulds dealer. Ask for Bulletin 720.4.

MEMBER

Goulds PUMPS INC.
Seneca Falls
New York

steam-absorption refrigeration unit in its general office building. Author describes (1) the installation, where and how it fits into the building (2) operation of the machine, its daily starting and stopping (3) cost data, in which actual and estimated costs are given.

The building uses purchased steam for its heating system. And costs of operation are highly interesting. Steam for 1300 hr of operation from March through November amounted to 2,535,000 lb and cost $2300.00, almost one mill per lb. This is the steam used for heating the solution in the generator and reconcentrating it, and also for reheaters in individual fan rooms.

Electricity for the solution pump, chilled-water and condenser-water pumps, all fans and all auxiliaries, totaled about $1240.00. The solution pump alone took $94 a month.

Water for makeup and for draining and cleaning the cooling tower, plus makeup in the chilled-water circuit, was metered and cost $212.00. So that total cost for utilities amounts to $3752.00. For the air-conditioning refrigeration machine alone utilities cost $2394.00.

If you add to this labor for system attendance and maintenance, the charge is $1339.00. For the unit only it drops to $766.00. *NDHA paper. No number.*

PROMOTION OF SUMMER LOAD THROUGH AIR CONDITIONING, *by Robert E Burke, New York Steam Corp.* About twenty years ago the New York Steam Corp began promoting summer load through air conditioning. At that time it was a 225-ton steam-jet unit sold to Cities Service Tower, then under construction.

Except during war years, number of installations have grown steadily until on the first of April 1950 there were 47, including the original one, using steam as the prime source of energy. Their combined capacity of 24,135 tons results in over 300 million lb of summer steam load.

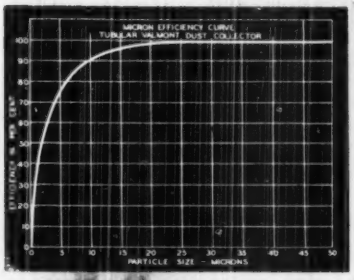
Provision for complete air conditioning has been included in practically all postwar commercial construction in New York. Within the next few years it is safe to say that no important existing building will fail to make similar provision where space for cooling towers, refrigeration equipment and duct work can be found. Even installation costs up to $1000 per ton seem no deterrent.

The release after the war of an economical absorption unit brings air conditioning within the reach of many buildings. Now the refrigeration equipment can be mounted on the roof or in a space close to the area to be conditioned, certainly away from an overcrowded basement. *NDHA paper. No number.*

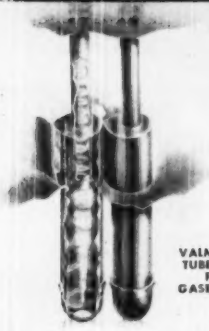
THE VALMONT TYPE S COLLECTOR

CATALOG DIGEST

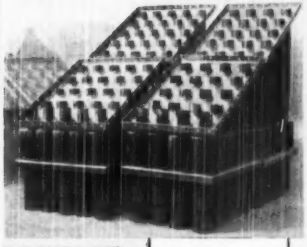
The following information is taken from the New Bulletin on P-D Valmont Type S Collector. For Complete Bulletin containing dimension tables, sizes, nomographs and suggested installation plans, write our Project and Sales Engineers.



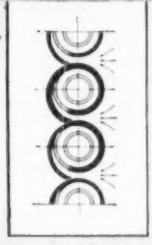
P-D EFFICIENCY CURVE



VALMONT TYPE S TUBES SHOWING FLOW OF GASES AND INLET



HORIZONTAL TYPE TUBE SHEET SECTIONS KNOWN AS "UNI-BLOCS"



METHOD OF NESTING TUBES—REDUCES TURBULENCE . . . SAVES SPACE

HIGH EFFICIENCY—The outstanding contribution to higher efficiency in the P-D Valmont Type S is the inlet slot design. A patented development of Prat-Daniel, this inlet is high and narrow, reducing the radial distance of dust-travel. To explain its effect on dust collection, we quote from Cyclone Dust Collector Design, by Melvin W. First, Paper No. 49-A-127, presented at the Annual Meeting of the American Society of Mechanical Engineers, Nov. 27—Dec. 2, 1949, page 14.

> "Entry width is an important variable in cyclone efficiency, as it controls the stream width. This, in turn, directly controls the radial distance particles must traverse to reach the cyclone wall and be separated by centrifugal force. The smaller the radial distance to be traversed, the lower the tangential velocity needed (less energy loss) and the smaller the particle that can be successfully separated for a given flow rate."

LONG LIFE—Extensive tests were made to determine the wear factor. All types of abrasive dusts were run at accelerated speeds, against various metals simultaneously and steel proved to be the most resistant to erosion.

Another long life factor is the lower velocity required due to the small tube diameter. It is a well-known fact that reduction of tube diameter produces higher centrifugal force. Thus, efficiencies are maintained at the lower load ranges.

MASS PRODUCTION METHODS—The P-D method of "uni-bloc" construction permits manufacture and assembly of sub-sections at the factory. These are shipped to the field and easily erected, either vertically or horizontally, to fit the layout. Savings in cost of erection are thus realized yet the collector is "tailor assembled" to fit the installation requirements.

SMALL SPACE FACTOR—Because of close nesting of tubes possible in P-D Valmont Type S Collectors, the space required for this apparatus is much less than conventional collectors. In many cases, P-D units have been fitted into spaces that could accommodate no other type.

The Thermix Corporation, our Sales and Project Engineers are specialists in the art of dust collection. Consult them about your dust problems.

Project and Sales Engineers

THE THERMIX CORPORATION

Greenwich, Conn.

(Offices in 28 Principal Cities)

Canadian Affiliates: T. C. CHOWN, Ltd.

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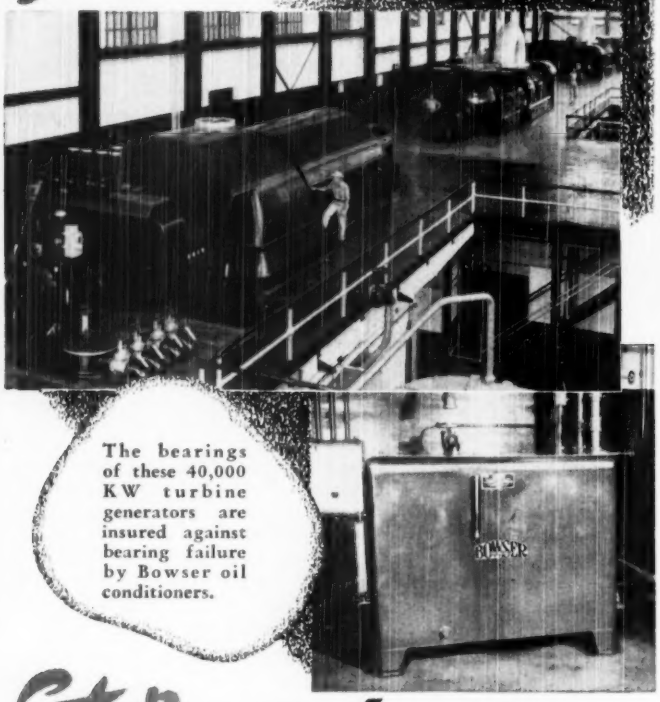
PRAT-DANIEL CORPORATION

Designers and Manufacturers of Power Plant Equipment for Over 25 Years

73-9 WATER STREET • EAST PORT CHESTER, CONN.

Longer life for Turbine Bearings



The bearings of these 40,000 KW turbine generators are insured against bearing failure by Bowser oil conditioners.

Stop THESE 6 ENEMIES OF TURBINE OIL NOW....

1. Turbulence
2. Air Entrainment
3. Moisture Contact
4. Heat
5. Metallic Contact
6. Removal of Inhibitors

When turbine bearings "stay-on-the-job," costly shutdowns are avoided and less standby equipment is required.

• • •

Write today for your copy of this new bulletin on the improved Bowser method for conditioning turbine oils.

BOWSER, INC., 1326 Creighton Avenue, Fort Wayne 2, Ind.

LIQUID CONTROL SPECIALISTS SINCE 1885

PLANT PROBLEMS

(*Continued from page* 130)

Fire to Center of Grate

MY EXPERIENCE in burning fibrous waste-material with bunker-C oil may be helpful.

We have two 5000-sq-ft watertube boilers under which we burn bunker-C oil and waste fiber from rope and binder-twine manufacture. Waste contains considerable oil, introduced during manufacture. It burns well when supplied with proper amount of air.

Our furnaces are large, 18 ft long, 10 ft wide, and about 12 ft high from floor to tubes. Waste is blown into furnace through front wall about 5 ft above the solid-brick furnace floor. Enough oil is burned with it to supply steam demand. There are four burners of pressure-atomizing type for each furnace, and one to three are operated with waste material.

We never have any serious trouble with ash adhering to tubes. If waste can be burned on a grate with air supply from underneath, combustion is better. Since *WH* will use a dutch oven for burning waste wood he can easily install a grate.

If wood waste is blown into furnace, consider arranging piping so fuel drops near center of grate. Minimum of air should enter with fuel. Control under-grate draft to give needed amount of air for good combustion with minimum of smoke.

When blowing wood shavings into furnace, we got best results with a conical pile of fuel in center of grate. Combustion air enters furnace around edges of pile.

Burning wood waste in a dutch oven with oil burner in bridgewall firing in opposite direction gives good combustion. If I were *WH*, I would not hesitate to combine the two fuels in same furnace with arrangement suggested. Make dutch oven large enough to accommodate wood-fuel, and feed fuel steadily. In our plant we control fuel oil to maintain steam-pressure at desired point.

C BROOKS HUDSON

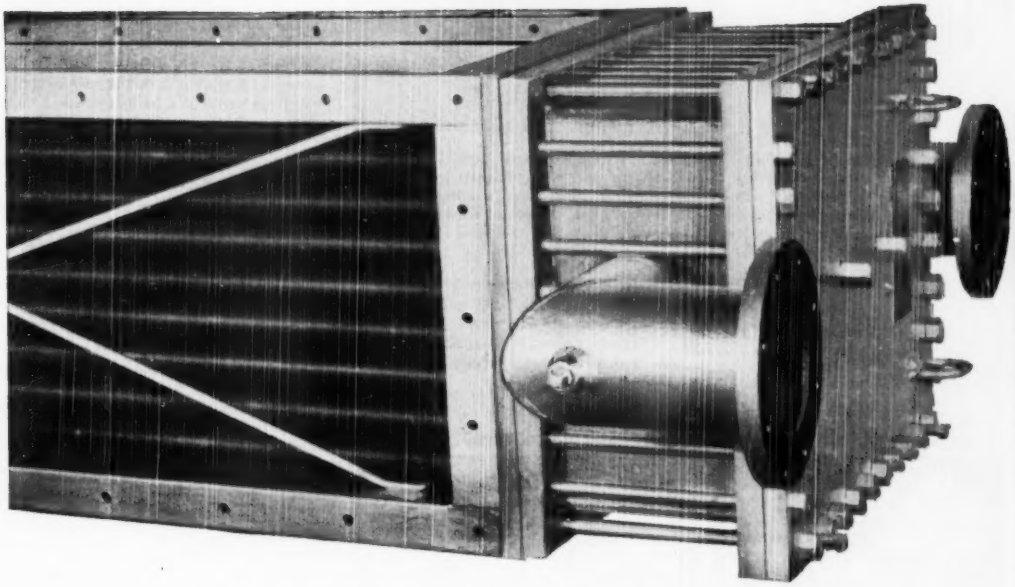
Plymouth, Mass.

Wood Ash May Fuse

I'VE MET THIS PROBLEM many times. In each case carryover from dutch oven deposited on floor of combustion chamber. High furnace temperature produced by oil fuses ash into a substance looking like volcanic rock when cold. Layer builds up, eventually requiring shutdown for removal. Easiest way to remove residue is by using jack hammer.

Deposits usually do not build up on waterwalls. If possible use a water-cooled floor on large boiler. On smaller

TO COOL OR HEAT
AIR OR GAS
....EFFICIENTLY



G-R K-Fin Units are admirably suited for air and gas cooling and heating duties. The use of K-Fin Elements with mechanically bonded helical fins, requiring no tinning, enables these units to withstand high temperatures and to operate successfully on duties where loosening of fins cannot be tolerated.

One of the distinctive features of the G-R K-Fin Cooler is its cooling surface of superior effectiveness. The K-Fin elements of this unit have helical fins. These fins, forming an extended outside tube surface, provide a higher heat transfer rate for a given air or gas pressure drop than is obtainable with other finned tube coolers.

When used as a *generator air cooler*, the K-Fin unit is embodied in a self-contained, closed, dust-proof and fireproof system, using turbine condensate or other available water supply as the cooling medium.

Some of the many other applications of this unit are for recovering gases from solvents, dehydrating illuminating gas, cooling gases from annealing ovens, and other gas cooling services.

Write for Bulletin 1219 describing all the features of the K-Fin Air and Gas Cooler.

GR 258

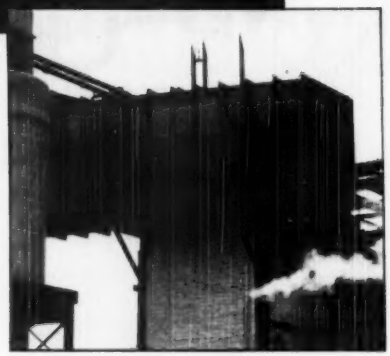
THE GRISCOM-RUSSELL CO., 285 MADISON AVENUE, NEW YORK 17, N. Y.

GRISCOM-RUSSELL

PIONEERS IN HEAT TRANSFER APPARATUS

For HIGH Quality, LOW Cost

Ask Littleford about Breechings and Ducts



They all look alike to Littleford . . . big jobs and little jobs, in any shape and in any weight of metal. Highly skilled craftsmen get the utmost out of modern facilities for shearing, punching, bending, rolling and welding. Give that next job of yours the benefit of Littleford's 68 years of engineering all kinds of powerhouse fabrications . . . send your blueprints for our quotation.

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438 E. Pearl St., Cincinnati 2, Ohio

DUCT WORK—BREECHINGS
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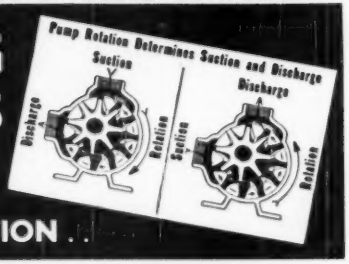
CUBICLES—PIPING—CABLE PANS

DON'T RISK A CHANCE OF BEING CONFUSED!

VIKING ROTATES in EITHER DIRECTION . .



WITH EQUAL EFFICIENCY!...EQUAL ACCURACY!

You merely reverse rotation of pump shaft to reverse flow of liquid in the Viking Rotary Pump. Figure at left shows pump with TOP SUCTION and SIDE DISCHARGE . . . at right, after reversing, SIDE SUCTION and TOP DISCHARGE. Simple and practical isn't it? And this flexible, time-saving feature makes Viking the ideal pump for fuel and lubricating oils. Bulletin 50SW shows you how the "2 in 1" Viking Pump can cut pumping costs and time. Write for a copy.

See Our Catalog In SWEETS

Viking PUMP COMPANY
Cedar Falls, Iowa

boilers this might be difficult to design and expensive to install.

I'm now installing a 40,000 lb per hr boiler for wood and oil fuels. Since it has a water-cooled floor I do not expect deposits. Previous jobs show this is true.

G J KIPPER *Seattle, Wash.*

It Works for Him

FOR FOUR YEARS we've been burning an average of 3.22 lb of wood dust per Imperial gal of bunker-C oil in a boiler with about 3500 sq ft of heating surface. At another location we're setting up an additional oil-fired 3-drum 4000-sq-ft boiler, and plan to burn dust in it.

Dust we burn can be classified as sawdust though it is mixed with asphalt. Heating value of dust mixture is 10,200 Btu per lb.

Dust is conveyed pneumatically to boiler room and is separated by a cyclone on roof. Cyclone-discharge pipe connects directly into boiler. A disadvantage is excess air which enters boiler when cyclone separating efficiency is low. I believe a screw feed could be used at base of cyclone without influencing air balance. Screw-feed eliminates dust-line flashback danger, though fusible-link dampers are fairly effective.

Each boiler is equipped with two oil burners. Dust is dropped into furnace as high as possible over top of burners and tends to burn in suspension.

On the basis of our experience, we would not hesitate to recommend burning 20% dry, light, wood shavings with bunker-C oil. We would not anticipate any difficulty from deposited ash on tubes provided furnace volume is sufficient. We have had no trouble and realize a substantial annual return on burning waste dust.

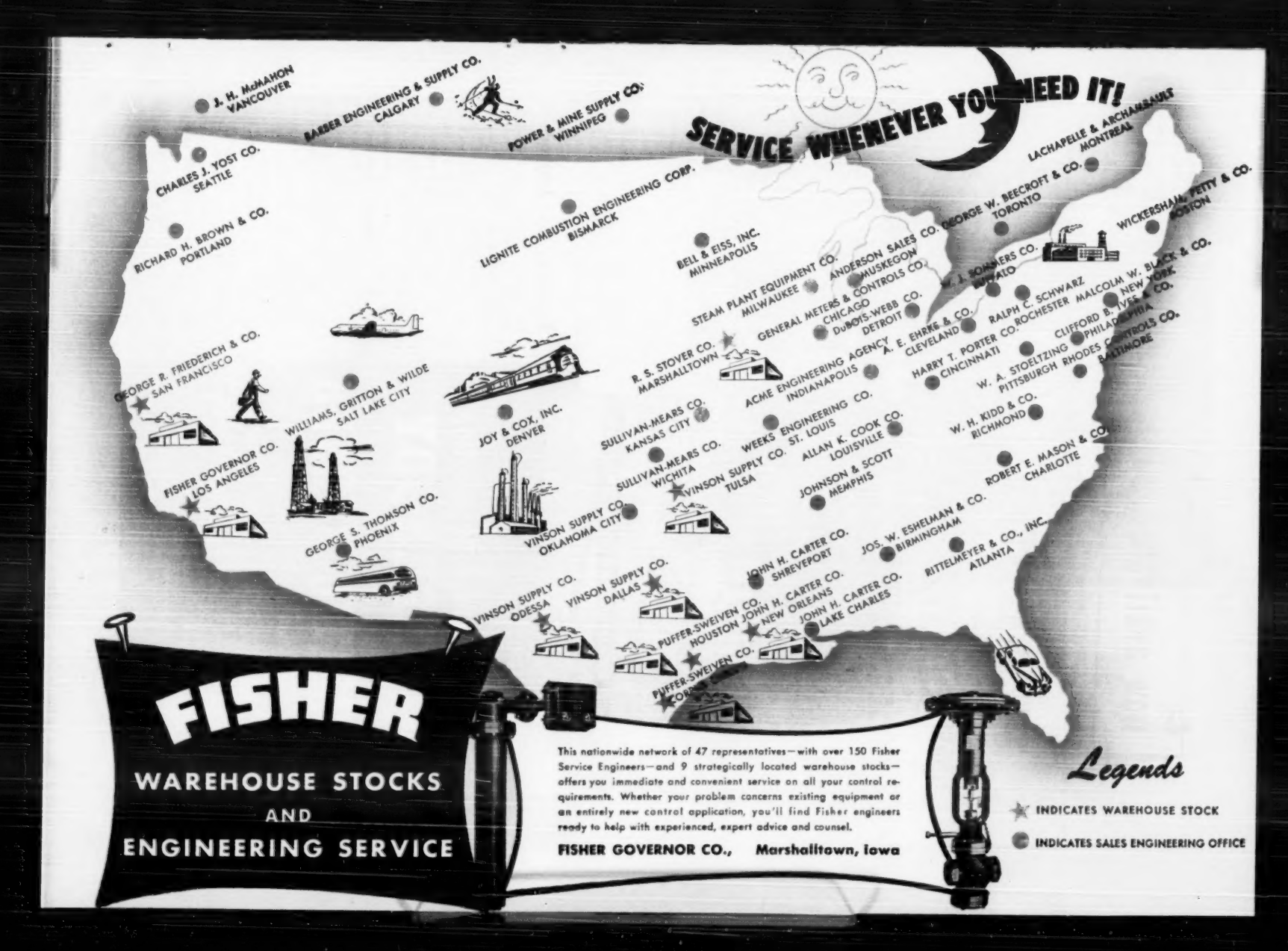
W A LAWSON *Montreal, Canada*

Well, Maybe . . .

THINK TWICE before burning oil and waste wood under one boiler. Back in '37 we had good results burning wood waste, consisting of sawdust, shavings and wood cuttings from a furniture factory. Boiler was an 18-ft x 72-in. hrt with dutch-oven setting. A 90-ft stack gave ample natural draft through grates with about 35% of air opening.

We often carried a heavy load from 7 am to 6 pm on only the wood-waste burning boiler. Main load was a compound steam engine driving an alternator. Boiler often worked at 250% of rating. Engine worked at 9 psi back pressure, exhaust steam being used for drying kiln coils.

When grates weren't overloaded and air passed through grates on all sides of conical fire, operation was good. Combustion was almost smokeless. A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This nationwide network of 47 representatives—with over 150 Fisher Service Engineers—and 9 strategically located warehouse stocks—offers you immediate and convenient service on all your control requirements. Whether your problem concerns existing equipment or an entirely new control application, you'll find Fisher engineers ready to help with experienced, expert advice and counsel.
FISHER GOVERNOR CO., Marshalltown, Iowa
Legends
INDICATES WAREHOUSE STOCK
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now available . . .

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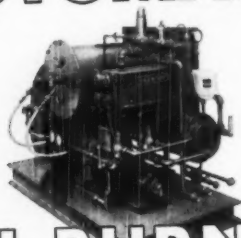
AUTOMATIC

OIL BURNER

PUMPS • HEATS • IGNITES
BURNS HEAVY FUEL OIL • FULLY AUTOMATIC
ALL IN ONE UNIT

DESIGNED ENGINEERED AND MANUFACTURED BY
PEABODY ENGINEERING CORPORATION
BULLETIN 400

Write for
complete, detailed description
of the new PEABODY
AUTOMATIC BURNER
Bulletin 400

PEABODY
ENGINEERING CORPORATION
580 FIFTH AVENUE • NEW YORK 19, N. Y.
Manufacturers of all types of combustion equipment, direct-fired air heaters, gas scrubbers, coolers, and absorbers.

OFFICES IN PRINCIPAL CITIES

dutch oven is ideal for waste wood because combustion space is large enough for burning highly volatile distilled gases. Between 0.6 and 0.8 cu ft of combustion space per sq ft of heating surface is needed, depending on wood used and draft.

WH's proposed boiler is 8000 lb per hr or about 2300 sq ft. He needs about 0.7 cu ft per sq ft or 2300 x 0.7 = 1610 cu ft of combustion space for working boiler at 100% of rating. With boiler worked at 200% of rating, combustion space needed is 3220 cu ft. If he tried to boost boiler rating by firing oil and waste wood together, combustion space might be too small. Poor draft, pulsations and incomplete combustion might result. There is also danger of an explosion of highly volatile distilled gases.

Since only 20% of fuel will be wood waste, this is enough for 4.8 hr of 24-hr boiler operation. I believe he should fire wood waste and oil alternately for best and safest operation.

Wood waste can be burned with coal-fired stokers by feeding waste through a spout in boiler front. Draft should be good and waste fed toward rear of fire, near bridgewall. Regulate waste feed so it won't choke coal-fire or draft. I believe this is his best bet if forced draft can be used. He should burn waste only during heavy load periods.

ARTHUR BELTON *Montreal, Canada*

Here are more good answers to POWER's May Question. We didn't have enough space to publish all in August—*The Editors*

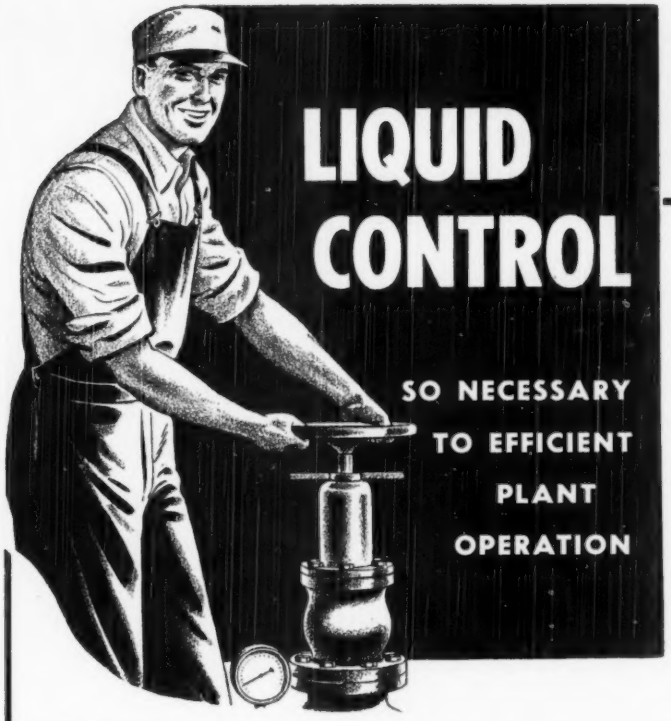
Practical Test Methods

CH SHOULD CORRECT his water-meter readings for temperature if it operates above or below 220 F. In our plant we use a recording thermometer in blowoff line to show the number of times boiler is blown and the time it was blown.

We believe in blowing down a certain amount in terms of gage-glass level and computing total from number of blows. This is more accurate than using the percentage of water fed, which may vary with steam generated from day to day. If *CH's* water meter is calibrated at 60 F and average feed temperature is 220 F, there may be an error of about 4.4% from greater volume per lb at higher reading unless meter constant is corrected for higher temperature.

Orifice-to-pipe-diameter ratios for meters *A* and *B* seem rather large for accuracy at low flows. A smaller orifice with a change in the recording mechanism to give desired capacity might be advisable.

Another error may be from varying density of steam, unless pressure and temperature are kept constant at points



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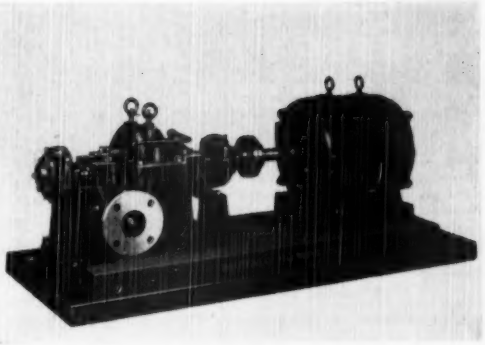

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Application data from which the steam rate and heat rate of any turbine may be determined from curves are also given. These make it possible to approximate quickly all data commonly used in preliminary design work.

June 1950 645 pages 221 illus. $9.00

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ON APPROVAL COUPON

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Please send me, on 10 days' approval, a copy of Salisbury's STEAM TURBINES AND THEIR CYCLES. If I decide to keep the book I will remit $9.00 plus postage; otherwise I will return the book postpaid.

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for which meter constants were figured.

In one meter in our plant, pressure drop from 135 to 100 psi causes an error of plus 12% if the 135-psi constant is used for 100-psi flow. Increase from 135 to 150 psi causes an error of minus 4.6% if the 135-psi constant is used at the higher pressure.

Steam-quality variation also affects meter reading unless compensated for, although error is not as great.

It might help *CH* to read meters at 8-hour intervals, say 7 am, 3 and 11 pm. Pressures and temperatures should be averaged for these periods and flow computed by using correct constants. This would give him a line on when the greatest variation occurred.

Unless all meters are read at same time there may be a difference between steam meters and water meter. For instance, a flow of 30,000 lb per hr is 500 lb per min; with a time lag of 5 min between reading of steam and water meters, a difference of 2500 lb may be found.

CH does not tell how he calibrated the boiler he used in checking his meters. I once calibrated a boiler for testing meters by putting a mark on the water column, filling boiler to marked point and then disconnecting the blowoff pipe outside the blowoff valve. Water was weighed with barrels and platform scales. This requires effort but is accurate because boiler can be filled through meter to marked level at any desired flow rate.

C BROOKS HUDSON *Plymouth, Mass.*

Run Plant Test

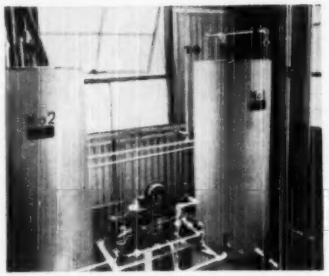
COMMERCIAL FLOWMETERS are usually guaranteed for accuracy of 2%, and usually are more accurate. The 10% discrepancy in *CH's* diagram and 6 to 7% implied in his question are excessive. Here are pointers on orifice-type meters that may help solve the problem:

(1) Meters checked and found accurate. Integrator mechanism should also be checked. This is usually actuated from chart mechanism, so chart is often more reliable than integrator if flow is fairly steady.

(2) Measure orifice and inside pipe diameters; they are not always size stated. Orifice must be correctly installed—concentric, with proper face up-stream. Pressure taps must be at correct points in pipe wall free from burrs or rough edges. Satisfactory approach and leaving conditions at each orifice are particularly important.

Measuring orifices should be preceded by about 10 pipe diameters of straight smooth pipe without valves or fittings, and followed by about 5 pipe diameters of straight smooth pipe. Flow disturbances from bends, restrictions,

MILTON ROY *"Packaged"* SYSTEMS



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etc, reduce or destroy accuracy of orifice meters. Fluid reservoirs at orifice must be at same level and pressure connections free of air pockets. *CH* can remove air bubbles from lines by blowing out with steam or water.

(3) Since an orifice meter is designed for a definite fluid, meter reading must be corrected for changes in pressure, superheat or quality.

(4) Orifice meters are designed for steady flow. Pulsating flow, as in feedwater line, may cause meter to read high.

(5) While meters are checked, any diversion of steam or water between feedwater and steam flowmeters must be stopped, or measured, accounted for.

(6) Remember, boiler efficiency doesn't give too reliable a check on steam or feedwater meters. Efficiency found depends on accuracy of oil flowmeter, which may be inaccurate.

(7) If each boiler ran alone it would be possible to check its steam flowmeter against feedwater meter. This might show up one bad steam flowmeter in group. If each steam flowmeter shows same disagreement with feedwater meter, this points to error in feedwater meter.

A backhanded way of approaching the same test, which might be more practical for *CH*, is to cut out one boiler at a time to see if discrepancy disappears when a particular boiler is out.

(8) Meter manufacturer wants his meters to give good service; he knows more about them and their proper application than anyone else. He should be able to solve this problem.

HUSTACE H POOR *New York, N. Y.*

Location May Be Wrong

CH's PROBLEM BOILS DOWN to having correct locations for pressure taps on downstream side of orifices. This applies to both types of meters.

Difference in pressure causes flow; unless his setup simulates the manufacturer's calibration tests, he cannot expect meters to read correctly. It would be a good idea to check this and these data are offered:

Meter	*Ratio d ÷ D*	*Distance, pressure tap downstream from orifice, inches*
A	.670	4
B	.704	3
C	.553	3¼
D	.449	3¼
E	.594	1

Also, *CH* should install air chambers on suction and discharge sides of feed pump to smooth out flow in line. Coefficient of volume varies with flow velocity at orifice.

HENRY R CARR *Buffalo, N. Y.*

(*Continued on page* 232)

CHASE VENTILATED BUS CONDUCTOR

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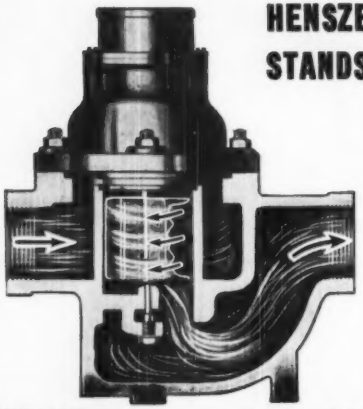

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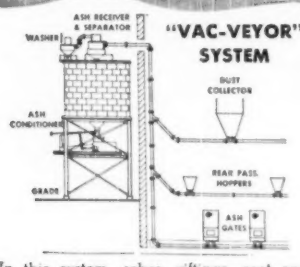

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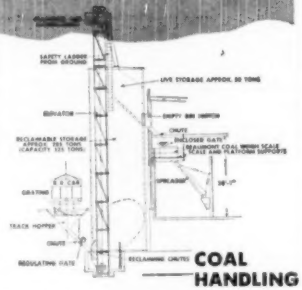

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Change Meters for Easier Reading

I HAVE the following suggestions:

1. Accurately determine quality of steam so flow constant can be corrected.

2. Observe flow rule: Maximum head in inches of water must not exceed absolute static line pressure. This means changing primary elements in B, C, D and E.

3. Change all maximum capacities so flows are at least 40% of maximum at all times. Also, use even quantities so chart multipliers and charts are directly readable.

4. Add a flowmeter to measure blowdown of entire system. This provides instantaneous checks.

5. Make these changes in feedwater flow section:

A. Add large-size condensation pots at orifice taps to offset thermal unbalance from rapid flow changes.

B. Include throttling orifice of 0.50 d/D ratio well upstream from measuring orifice.

C. Include a low-head meter in measuring section. Meter must be able to follow flow changes.

6. Check or make all new orifices flat, sharpedged and to ASME standards. All drain holes should work.

The following table is a guide only for the changes recommended:

Meter	Range in. H_2O	Capacity lb/hr	Press. psi	d/D	Orifice Coeff
A	112.08	40,000	135	.66	.677
B	103.3	30,000	135	.72	.713
C	71.74	15,000	75	.67	.682
D	45.91	10,000	135	.56	.638
E	183.66	100,000	—	.67	.682

Observe that:

(1) Maximum capacities are even figures.

(2) Ranges of flowmeters in inches of water do not exceed line pressure.

(3) Proposed changes in range conform to *CH's* problem; scale changes give easily read meter capacities.

F R BRYDGES *Battle Creek, Mich.*

McGraw-Hill World News—The Electricity Supply Commission, Johannesburg, South Africa, is to build another big power station for the Witwatersrand at a cost of about $20,000,000. The plant will be a coal pithead station drawing fuel from the Clydesdale colliery.

Secondary recovery methods are credited by the **U S Bureau of Mines** with producing over half the original yield of 705,000 barrels of oil from the once-abandoned 348-acre Brenneman field in the Grant district of Hancock County, W. Va. Injection of gas into the underground reservoir forced oil into the producing well. A free copy of the Report of Investigation 4690 may be obtained from the Bureau of Mines, Publications Distribution Section, 4800 Forbes St, Pittsburgh 13, Pa.

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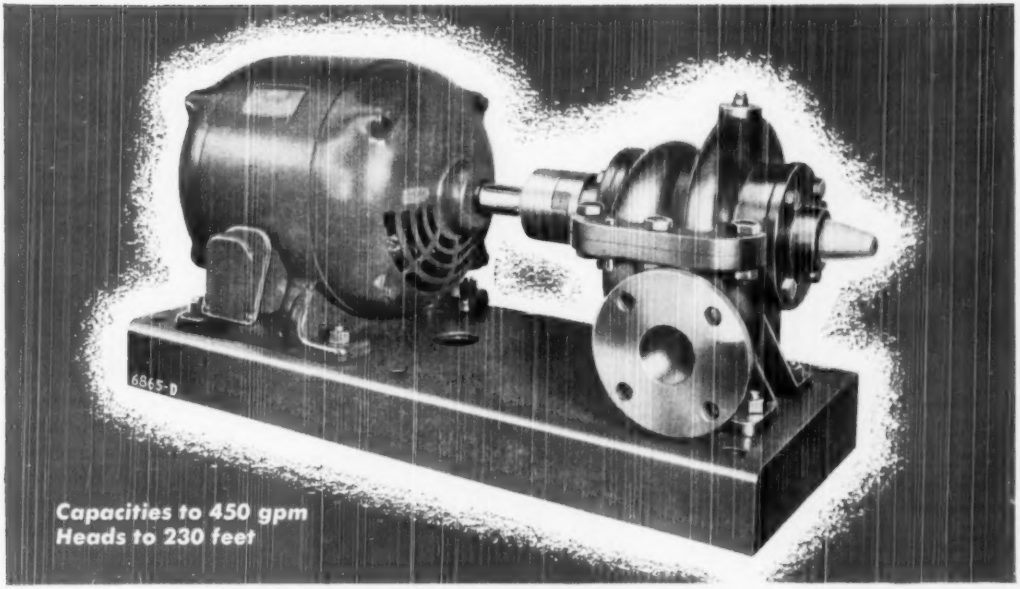

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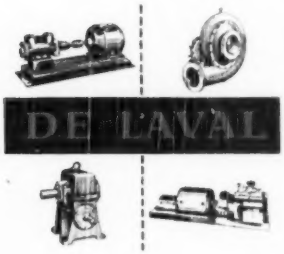

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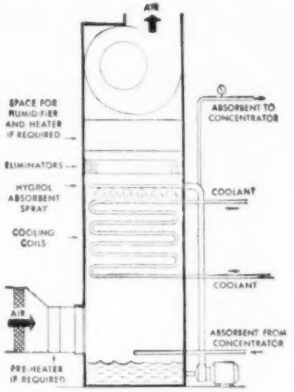

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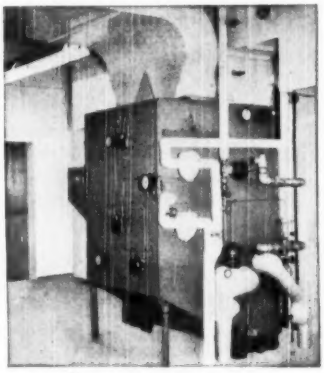

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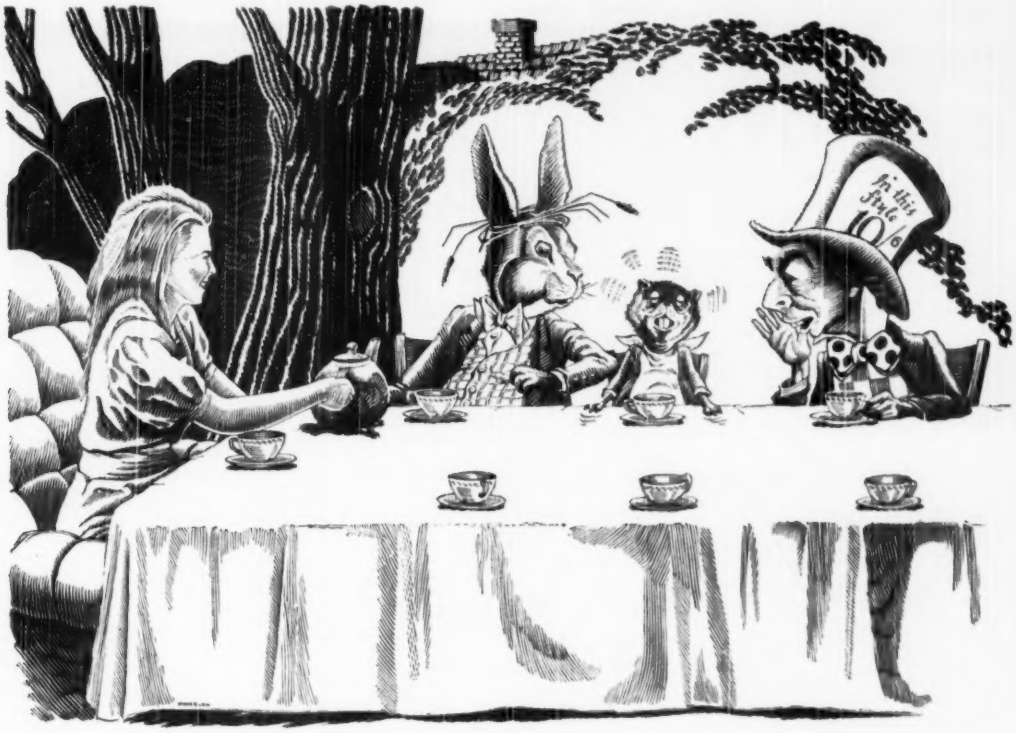

"I wasn't asleep," said the Dormouse

EVERY boy and girl knows the drowsy Dormouse of Alice in Wonderland. He was elbowed and pinched by the Mad Hatter and the March Hare as he mumbled in his sleep at the tea party.

But our young people aren't so well versed in everyday economics. They have a sadly distorted picture of the profits of business. They don't realize why profits are necessary, how small they are, or how they are divided.

For instance, in a recent survey of high school seniors, it was discovered that they believe over 50% of the sales dollar is profit and they think stockholders receive 24% of it. Actually business profit averages less than 8%, with less than 3% distributed as dividends. Business uses most of its profit, moderate as it is, for new plant and equipment, to improve products and to make more jobs.

Misconceptions among our youth bode ill for America's future. They open the door for too ready acceptance of dangerous isms and false foreign philosophies. Such misunderstanding of economics can be corrected only with facts supplied by business itself. You as a leader in your community must share this responsibility.

The American business man must not allow himself to be cast in the role of the Dormouse, pinched and pilloried by the March Hares of communism and the Mad Hatters of the "everything for nothing" state.

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The Tri-Lok Company is also equipped to furnish *riveted* and Tri-Forge *welded* open steel flooring. Tri-Lok grating can be furnished in a variety of metals, including aluminum alloy, stainless steel, etc. Write for Bulletin MW1140.

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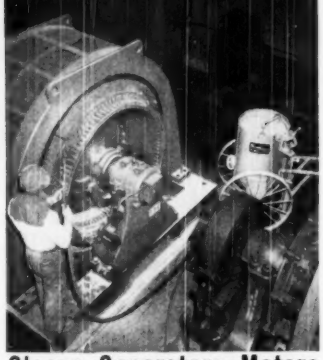
National Distributor for the Tri-Lok Company

Dravo Bldg., Pittsburgh 22, Pa.

Sales Representatives in Principal Cities

PANGBORN AC-4

"CORN COB" Blast Machine



Cleans Generators, Motors

Faster Better Cheaper

Eliminates Toxic Hazard of Solvents!

THE new portable Pangborn AC-4 Blast Machine scours armatures, parts, frames, coils, etc. in ⅓ the time of other methods. Material costs are reduced 90% and toxic or explosive solvents are eliminated.

Look at the savings shown by this recent test on electric motors. (Name of Company on request.)

Cleaning Duplicate 500 hp Synchronous Motors		
	Material	Labor
Solvent Method	$55.00	120 hrs.
PANGBORN Method	5.00	40 hrs.
SAVING	50.00 (90.9%)	80 hrs. (66.7%)

Remarks: With Solvent, drying period took an additional 8 hours.

SIMPLE OPERATION

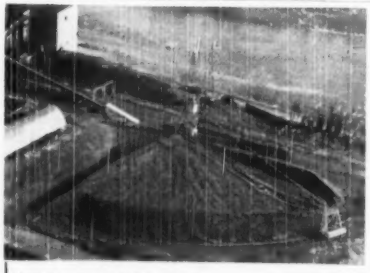
New Pangborn AC-4 Blast Machines use standard 40-pound air supply to remove oil and greases with blast of soft, 20-mesh corncob grits. No residue left on parts . . . no drying period.

FOR FULL INFORMATION, write today outlining your operation. Address: PANGBORN CORPORATION, 90 Pangborn Blvd., Hagerstown, Maryland.

Look to Pangborn for the Latest Developments in Blast Cleaning and Dust Control Equipment

Pangborn

BLAST CLEANS CHEAPER with the right equipment for every job



Above is a 2 cu. yd. Sauerman Power Scraper handling a 20,000-ton stockpile of slack and run-of-mine coal at the power plant of the Holyoke Water Power Co.

•

Advice and Literature Freely Supplied

In our 41 years of service to industry we have provided plans and equipment for a large percentage of the important coal storage projects in this country. In many cases, the problem is brought to us by a consulting engineer or manufacturer of other equipment who has been commissioned to design a complete coal handling and boiler plant installation.

Write us about your storage problem. We will mail you our catalog and our suggestions on equipment without obligation on your part.

SAUERMAN one-man SYSTEM!

for Stockpiling Coal

• Have you the problem of storing more coal without using more labor? You can do it easily—rapidly—any tonnage from 10 to 500 t.p.h.—with a Sauerman Power Scraper.

A Sauerman Scraper is simple and easy to operate. From a station overlooking the storage area the operator has automatic control of every move of the scraper.

The machine stocks the coal in compact layers. There is no segregation of lumps and fines — no air pockets to promote spontaneous combustion.

Each Sauerman installation is a permanent, trouble-free investment — maintained at small expense.

SAUERMAN BROS., Inc.

562 S. CLINTON ST., CHICAGO 7, ILL.

THEIR JOB is to help you get..

Mr. Claude Waltz, operating a Bullard high-speed boring mill here, started at OIC in 1896, at age 19, as an apprentice machinist.

This new, modern Southwark-Emery physical test machine, in daily use, is one of the many mechanical aids added in the 40 years of precision engineering experience of Messrs. Malaney, Doster and Turner.

Mr. A. A. Kruse, factory trained in precision application of valves, is one of many O. I. C. representatives in various parts of the nation qualified and available to aid both distributors and users in valve applications.

Precision Engineering of valve designs, Precision Manufacturing and Precision Application—OIC considers all three factors equally essential to good valving. OIC has the years of experience and the service organization to give you all three.

We point with pride to these veteran members of the OIC organization as evidence: Mr. Claude Waltz has been contributing precision machining for 54 years. Mr. D. B. Malaney, Metallurgist, Mr. H. G. Doster, Vice President in Charge of Engineering, and Mr. J. B. Turner, Product Engineer, combine 40 years of service in precision engineering. Mr. A. A. Kruse, Jr., who began in our Engineering Department, is now one of the many field engineers advising users on precision valve application in various parts of this country.

If you're needing valve *application know-how*, call the nearby OIC distributor for the help of a factory representative, or write direct to us. The Ohio Injector Company, Wadsworth, Ohio.

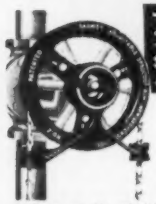
OIC
FOUNDED 1891

VALVES

FORGED AND CAST STEEL · IRON · BRONZE

FOR SAFETY'S SAKE

Control Valves from the Floor



Babbitt *Adjustable* SPROCKET RIM *with Chain Guide*

ELIMINATES STEP-LADDER CLIMBING RISKS

● Range of 10 adjustable sizes takes care of all valve makes and types; fits valve wheel diameters from 2 to 30 inches.

● Climbing on benches, machines, boilers or treacherous stepladders to control overhead valves is absolutely unnecessary, foolish risking of life and limb. Why permit such risks when the safe and sure BABBITT Adjustable Sprocket Rim with Chain Guide is available at such low cost? Overhead valves are conveniently and safely operated right from the floor!

● The BABBITT Adjustable Rim fits all valves, with either rising or non-rising stems. It is installed quickly by clamping onto the hand wheel of the valve.

● *Write today for Catalog Bulletin P, surprisingly low prices, and name of nearest distributor.*

BABBITT STEAM SPECIALTY CO.
1 Babbitt Square, New Bedford, Mass.

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- Mechanical Atomizing Oil Burners
- Steam Atomizing Oil Burners
- Refractory Burner and Muffle Blocks
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- Low Air Pressure Oil Burners
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- Valves, Strainers, Furnace Windows
- Tandem Block Combustion Units
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YOU CAN CUT PIPING COSTS with CATAWISSA PERFECT SEAL UNIONS

CATAWISSA HOT FORGED STEEL UNIONS priced to compete with better grade malleable iron unions

also . . . DOUBLE EXTRA HEAVY FORGED STEEL SWING CHECK VALVES 600-lbs. W.S.P.

a type for every use! CATAWISSA STAINLESS STEEL UNIONS machined from solid bars

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INTEGRATED POWER SYSTEM

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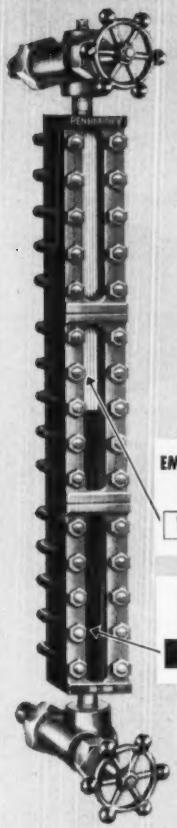
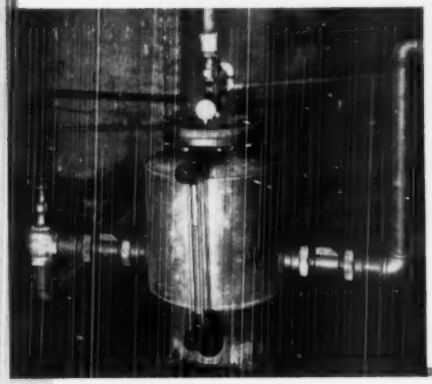
PENBERTHY REFLEX LIQUID LEVEL GAGES



You can't misread the Penberthy Reflex Liquid Level Gage . . . *it prevents mistakes.* Due to a simple, invariable optical principle, the empty space always shows white . . . the liquid black. In addition to standard units, Penberthy Reflex Gages are fabricated to customers' specifications from special alloys to meet unusual corrosive, pressure and temperature conditions. Write for new Catalog No. 35.

PENBERTHY CYCLING JET PUMPS



Operated by air, gas, or steam pressure, pumps (without clogging) any liquid that will flow through pipes. Lifts fluid from lower level and discharges against pressure approximately equal to operating gas pressure. Operates automatically by ejector that exhausts the vessel . . . drawing in liquid . . . then gas pressure pushes it out. Ejector and its control valve not in contact with fluid pumped. Corrosion proofing easy. Write for Bulletin 5030.

PENBERTHY EJECTORS

A simple jet pump operated by air, water or steam. Has no moving parts . . . needs no lubrication. Will not get out of order . . . wear is not appreciable. Reliable, noiseless, compact, convenient and initial cost is very low. Made in bronze, iron and wide variety of materials that successfully withstand corrosion, contamination and high temperatures. Special units developed to meet unusual conditions. Write for Catalog 34.

PENBERTHY *Explosion Proof* SUMP PUMPS

Motor and switch totally enclosed, this pump has Underwriters approval for Class I, Group D, and Class II, Groups E, F and G hazardous locations. These include gasoline, solvent vapors, metal dust, natural gas, carbon black, naphtha, alcohol, grain dust, acetone, lacquer, coal and coke dust, etc. Made of copper and bronze throughout, this pump is corrosion proof, durable, thoroughly dependable. Write for Bulletin 4929.

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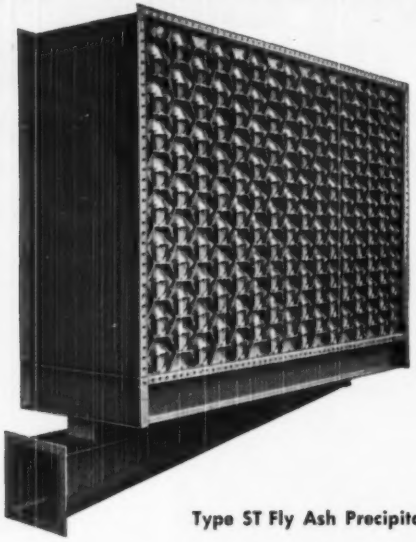
PENBERTHY INJECTOR COMPANY

DETROIT 2, MICHIGAN

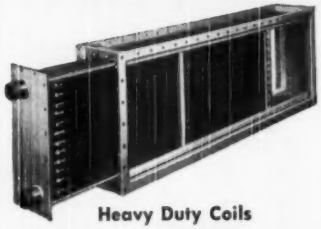
Established 1886 *Canadian Plant, Windsor, Ontario*

4290

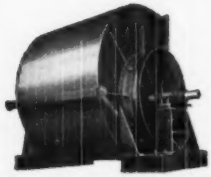
Solve your *fly ash problem* with an AMERICAN BLOWER FLY ASH PRECIPITATOR



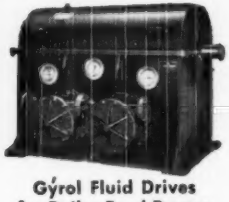
Type ST Fly Ash Precipitator



Heavy Duty Coils

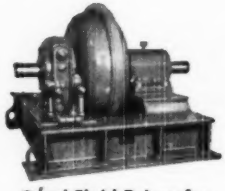


American HS Forced Draft Fans



Gýrol Fluid Drives for Boiler Feed Pumps

Sirocco Induced Draft Fans



Gýrol Fluid Drives for Mechanical Draft Fans

There are many advantages in using American Blower Type ST Precipitators for fly ash problems. Unique in design, simple in operation and low in maintenance cost, these units contribute materially to over-all power plant efficiency.

They automatically maintain high efficiency over the entire boiler load. Even at reduced loads, when fly ash is more difficult to remove, the Type ST Precipitator is relatively more efficient.

In addition, all element cells are die-formed, interchangeable and housed in a single, compact casing. Type ST units are flexibly designed to fit the job. They may be shipped for field assembly, or semi-assembled. They're available in a wide range of sizes to meet a variety of needs.

If you have a fly ash problem, why not call in an American Blower Field Engineer and work your needs out together? He has a wealth of experience behind him and excellent firsthand data at his disposal on Fly Ash Precipitators as well as on American Blower Heavy Duty Coils, Mechanical Draft Fans and Gýrol Fluid Drives for fan control and boiler feed pumps. Simply contact the nearest American Blower Branch Office—conveniently located in all principal cities.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

YOUR BEST BUY AMERICAN BLOWER POWER PLANT EQUIPMENT

Serving home and industry

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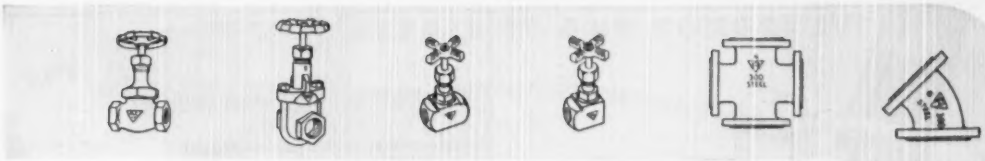
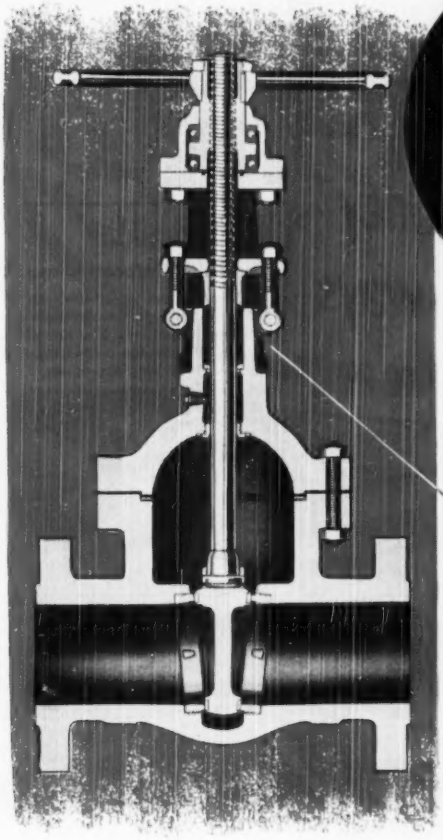


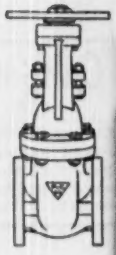
You'll benefit by using

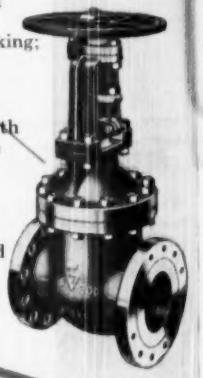
R·P&C
CAST STEEL VALVES



Note the **quality features** of this Gate Valve. They are typical of all valves in the R-P&C Cast Steel Line--gate, globe, angle and check valves in pressure classes 150 lb. through 1500 lb.

- **Ball Bearing Operating Nut** permits smooth operation with minimum effort.
- **One Piece Yoke with Cap** provides rigidity, perfect alignment and easy access to operating nut.
- **High Quality Packing** assures a tight stuffing box under all conditions—low stem friction—minimum servicing.
- **Gland and Follower with Ball Joint** applies uniform pressure on packing, prevents follower binding with stem.
- **Heat-treated Stainless Steel Stem** has high strength and corrosion resistance. Polished surface increases life of packing; T-head makes strong, self-aligning connection with wedge.
- **Solid I-Beam Wedge** is guided to proper seating by guide ribs cast integral with the body. Wedge seating surfaces are precision ground to fit perfectly with body seat rings.
- **Barrel-type Seat Rings** have heavy, uniform section; offer no points of high stress concentration; have broad seating surface, ground smooth for less wear—longer life. Port opening is full pipe diameter.





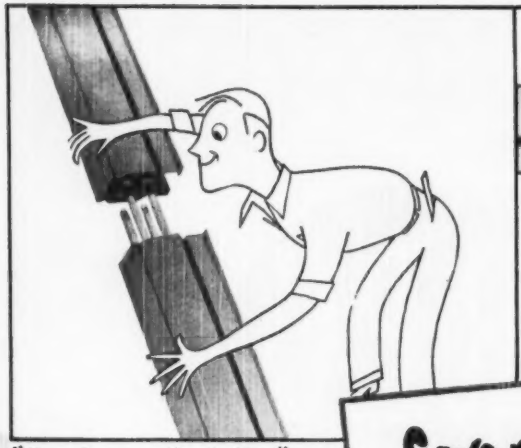
***In addition** to the standard line, R-P&C offers cast steel gate and globe valves with Pressure Sealed Bonnet joint—especially adapted for high pressure, high temperature service. For information, get in touch with your nearest R-P&C District Office.*

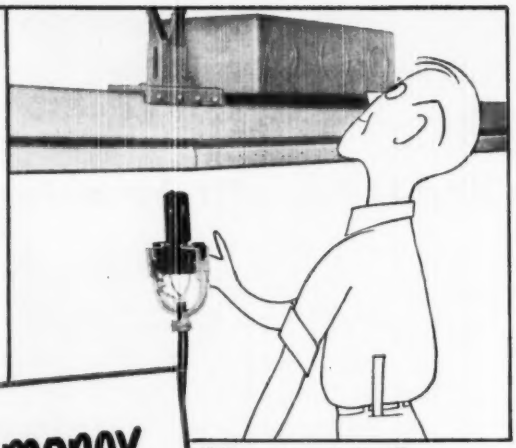
ACCO Reading, Pa., Atlanta, Baltimore, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Connecticut

R-P & C VALVE DIVISION
AMERICAN CHAIN & CABLE

TRADE MARK

READING-PRATT & CADY VALVES





Save money these 3 ways when distributing power

"Quick-install-ability"

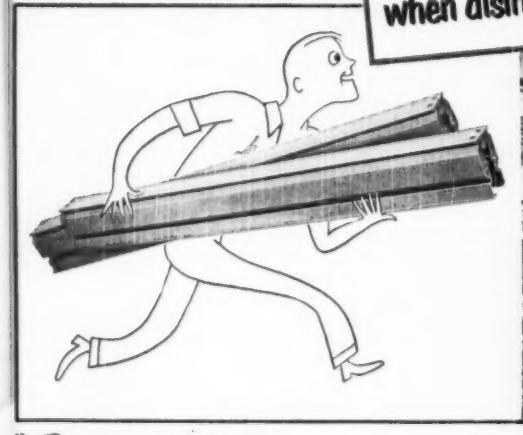
saves initial cost

LTG FLEX-A-POWER busways are pre-fabricated housings which are easily coupled in any arrangement and in runs of any required length. Time for installing is much less than for wiring and conduit.

"Plug-in-ability"

saves time relocating machines

Take-off plugs or trolley can be inserted anywhere (no drop-out section needed for trolley). You can add or relocate loads without rewiring expense and without long extensions.



"Take-apart-ability" saves material expense

Whenever a *major* relocation of outlets is required, the entire FLEX-A-POWER system can be dismantled, removed to another location and re-installed with practically 100% re-use of materials.

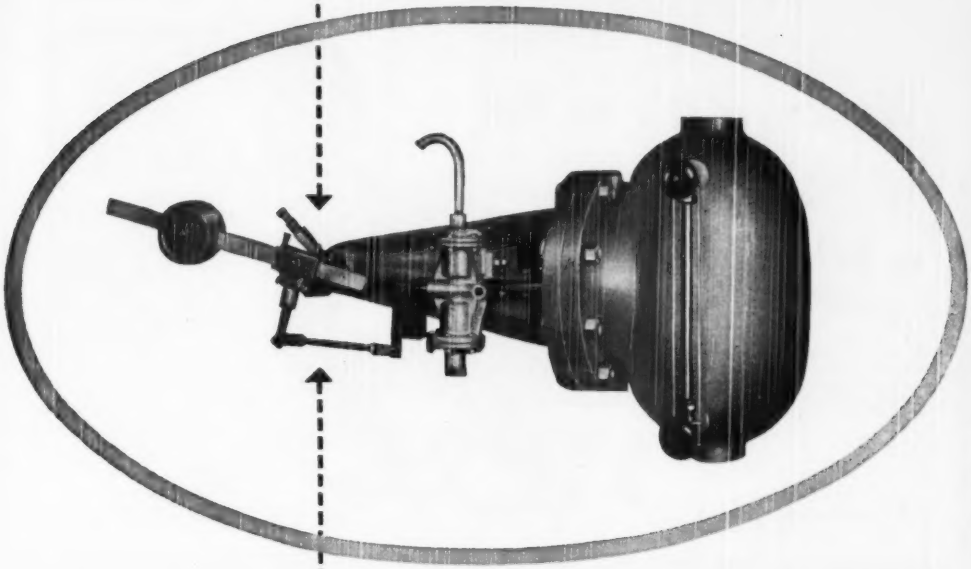
Sealed Power Corp. saves with Flex-a-Power

LTG FLEX-A-POWER, one of six forms of FLEX-A-POWER for various services from main breakers to individual loads, is designed for light-duty lighting, small tools, appliances. Write for Bulletin TEC-3, THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn.

TRUMBULL (T) ELECTRIC

TRUMBULL'S TRAIN OF NEW PRODUCTS

INSTALL IT AND FORGET IT!



For Economical and Dependable Liquid Level Control

...THE HONEYWELL FLOAT CAGE

USER reports show up to ten years of accurate, dependable service . . . on surge tanks, feedwater heaters, evaporators, deaerating tanks, stills and other process equipment! This eliminates one troublesome maintenance problem . . . and, at the same time, assures the continuity of service that leads to greater processing efficiency.

Honeywell Float Cages are supplied either with direct connection for mechanical operation, or with on-off or throttling type pilot valve for pneumatic operation. In addition, the Honeywell line includes internal float type level controllers for use where vessel design and conditions permit.

Honeywell Float Cages are available in Bronze, Cast Iron, or Cast Steel . . . with Bronze, Stainless Steel or Special Alloy trim. Float sizes—6", 8" and 10".

Call in your local Honeywell engineer for detailed information about these float cages and such other Honeywell Control Specialties as Hi-Lift Hand Control Valves, Non-Lubricated Cylindrical Plug Valves, Transfer Valves, and the Honeywell Space-Saving Bypass.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 1900 Windrim Avenue, Philadelphia 44, Pa. Offices in more than 80 principal cities of the United States, Canada and throughout the world.

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WORLD'S LARGEST ORGANIZATION FOR ADVANCED INSTRUMENTATION AND CONTROL

Honeywell
VALVE PRODUCTS

We know it's no fun to wait for a BOILER

WICKES ENGINEERS appreciate the importance of hurrying up your boiler specifications, drawings, fabrication, installation and service.

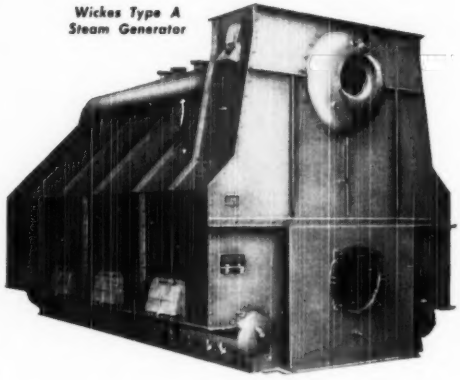
When you are planning the installation of a new steam generator, you naturally want service in a hurry . . . right from the time the first drawings are made 'til the day you raise steam pressure.

You get service from Wickes before the sale and after the installation. We're big enough to engineer the kind of job you need and give you the kind of service you want.

From the standpoint of boiler efficiency, too, it pays to call on Wickes. In fact, Wickes has been designing and building good, dependable, boilers since 1854.

Write or phone your nearest Wickes representative or get in touch with our engineers here in Saginaw.

Wickes Type A Steam Generator



WICKES

127

THE WICKES BOILER CO.
SAGINAW, MICHIGAN
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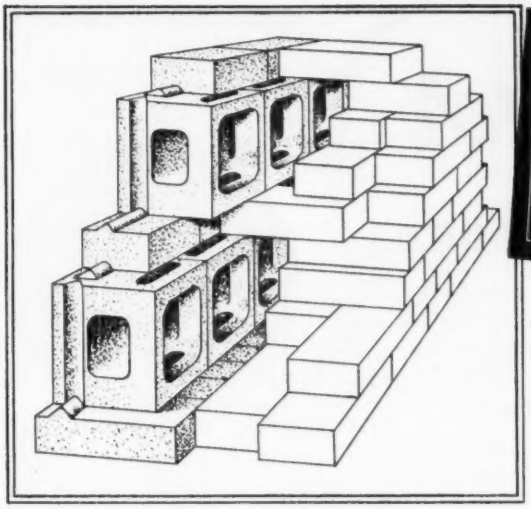
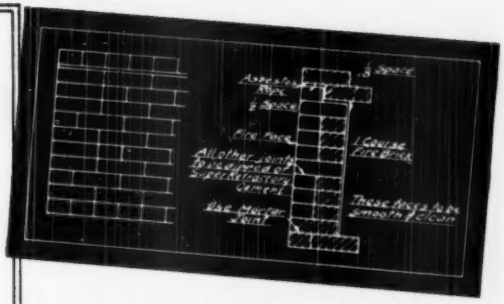




ILLUSTRATING CONSTRUCTION OF SOLID WALL with up to 9 courses of Norton Crystolon bricks laid with Norton Alundum cement. Such walls pay for themselves many times over because of freedom from clinker adherence and lower labor costs for cleaning.

AIR-COOLED WALLS of Norton Type A Crystolon* Hollow Blocks and Crystolon Bricks laid with Norton Alundum* cement for outlast fire-brick and other types of refractory walls. Norton Type B (T-shaped) and Type C (U-shaped) blocks and bricks are also available in Crystolon refractory for replacement purposes.

How to build EXTRA LIFE *into your boiler walls*

If fire-clay brick walls are causing you to shut down boilers frequently for repair of spalled, eroded or cracked refractories, it will pay you to switch to special refractories made of silicon carbide.

Many power plants report longer life and lower over-all costs from the use of Norton Crystolon silicon carbide refractories.

Air-Cooled Walls

Norton Crystolon hollow blocks and solid bricks with mating tongues and grooves have been designed to simplify the construction of air-cooled walls in boiler furnaces. While the unique design of these blocks makes a hit with masonry crews, it's the physical and chemical properties of Norton Crystolon refractory that really pay off.

Made of dense silicon carbide with a minimum of refractory bond, Norton Crystolon shapes are highly resistant to the four common causes of boiler wall failure. (1) Being highly refractory, they successfully resist temperatures up to 2900°F. (2) They're so dense that they effectively resist slag penetration. (3) Resistance to clinker adhesion is also high. However, if clinkers do adhere to a limited extent, their rugged strength permits removal without damage to the surface of brick or block. (4) Since silicon carbide is an extremely hard abrasive in its own right, Crystolon shapes are not noticeably affected by abrasion, even that caused by the moving fire bed of stoker-fired furnaces.

Solid Walls

The same advantages that make Crystolon hollow blocks such a good investment for air-cooled walls also apply to Crystolon bricks for solid walls. Their longer service and lower maintenance cost more than compensate for the cost differential between them and ordinary fire brick.

For best results, not less than five courses of Crystolon brick should be used in any boiler furnace. Only in the case of unusually thin fire beds or other exceptional operating conditions are fewer courses satisfactory.

Alundum Cement

Whether you decide on air-cooled or solid walls of Crystolon refractories, Norton RA-1019 cement is recommended for laying up the blocks or bricks. This cement is chemically stable and assures a very strong bond. Used as a slip for making dipped joints, this fine-grained aluminum oxide cement matures at 1850°F and withstands temperatures up to 3100°F.

Write for Bulletin 862

For more complete information about Crystolon shapes and Alundum cement, consult your nearby Norton representative, or write direct for Bulletin 862. NORTON COMPANY, 600 NEW BOND ST., WORCESTER 6, MASS.

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

NORTON

TRADE MARK REG. U. S. PAT. OFF.

Making better products to make other products better

Special REFRACTORIES

Canadian Representative

A. P. GREEN FIRE BRICK CO., Ltd. TORONTO, ONTARIO

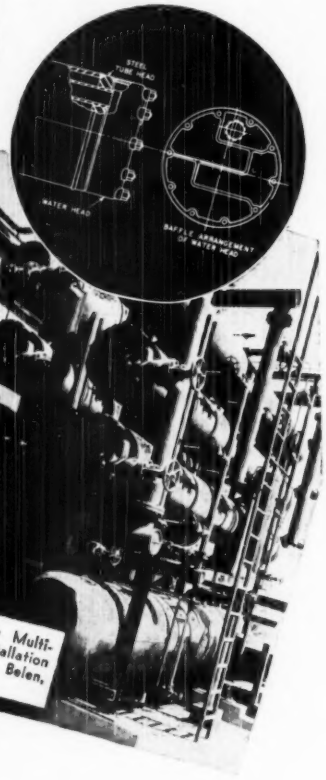
$ave Power and REFRIGERATION COST

Vogt Condensers, because of their correct design, STEP UP the rate of heat transfer and STEP DOWN head pressures. With the liquid delivered at a lower temperature, smaller compressor capacity is needed, saving in original as well as operating costs.

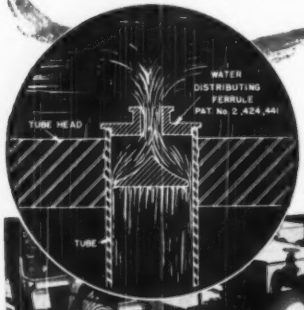
One of the two basic types illustrated will fit your operations exactly. Install Horizontal Multipass (closed type) for use with clean waters. Where the water is hard, forms scale, contains mud or promotes fungus growth, Vertical Single Pass (film type) which can be cleaned in operation, are recommended.

Horizontal Multipass Condensers
(Closed Type)

Water circulated in tubes traverses the length of the unit a number of times as determined by baffles in the heads.

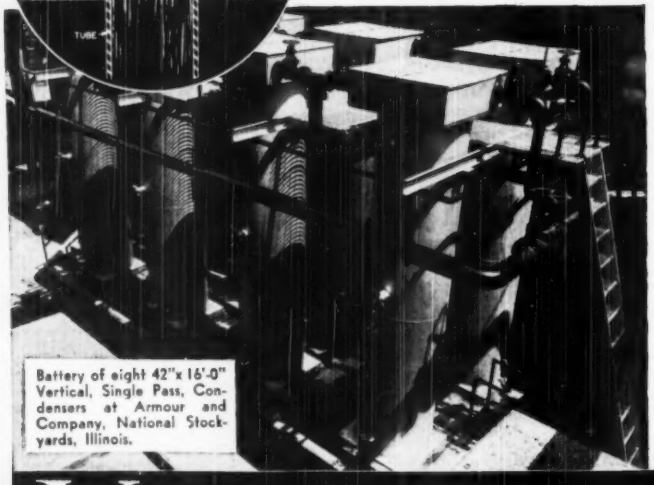


375 tons capacity Multipass Condenser installation at Railways Ice Co., Belen, New Mexico.



Vertical Single Pass Condensers
(Film Type)

Patented ferrules give equal distribution of water to and over the surfaces of all tubes in a unit.



Battery of eight 42"x 16'-0" Vertical, Single Pass, Condensers at Armour and Company, National Stockyards, Illinois.

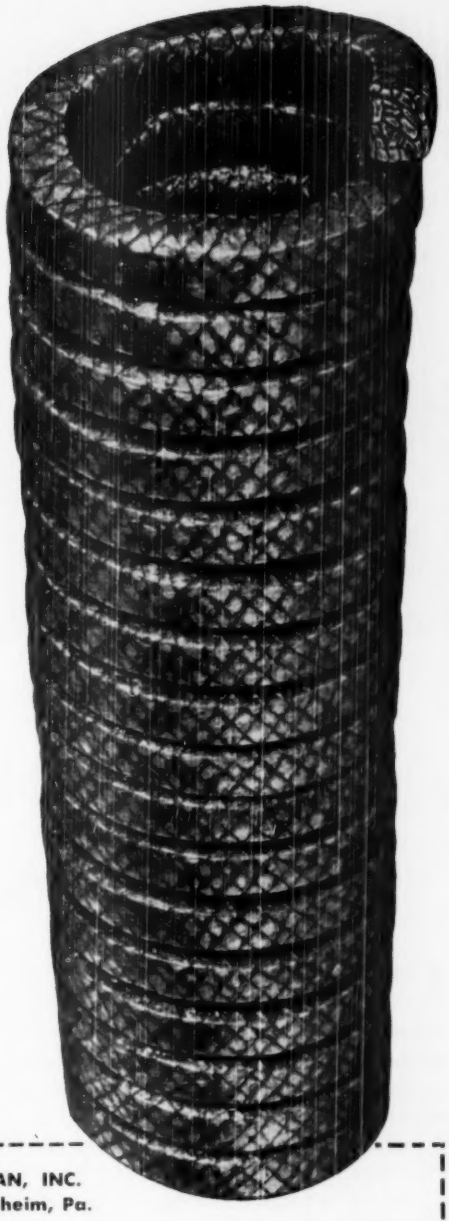
HORIZONTAL and VERTICAL TYPES SHELL and TUBE CONDENSERS For Every Service

Write For Bulletin RC-1

HENRY VOGT MACHINE COMPANY
INCORPORATED
1000 W. ORMSBY ST., LOUISVILLE 10, KY., U.S.A.
Branch Offices: NEW YORK, CHICAGO, CLEVELAND, DALLAS, PHILADELPHIA, ST. LOUIS, CHARLESTON, W. VA.

Vogt REFRIGERATION CONDENSERS

GET longer wear with R/M NO. 920 the flexible metallic packing



R/M No. 920 is one of several R/M metallic packings that combine long-wearing quality with an anti-frictional surface that preserves rod or shaft. R/M No. 920 is made of asbestos yarns covered with metal foil, a combination that is highly resilient and flexible. Recommended for steam and air rods, centrifugal pump shafts, valve stems, expansion joints, and applications where temperature does not exceed 450° F. and surface speed is not greater than 600 feet per minute.

For complete information about R/M No. 920 and the full line of R/M packings, see the authorized R/M packing distributor near you, or mail the coupon below.

RAYBESTOS-MANHATTAN, INC.

PACKING DIVISION, MANHEIM, PA.

FACTORIES: Bridgeport, Conn.; Manheim, Pa.; No. Charleston, S.C.; Passaic, N.J.

RAYBESTOS-MANHATTAN, INC., Manufacturers of Packings • Asbestos Textiles Mechanical Rubber Products • Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings • Brake Blocks • Clutch Facings • Fan Belts Radiator Hose • Powdered Metal Products • Bowling Balls

RM

RAYBESTOS-MANHATTAN, INC.
Packing Division, Manheim, Pa.

Gentlemen: Please send me data on R/M No. 920. **P-90**

Name_____

Position_____

Company_____

Address_____

City_____ Zone_____ State_____

General View—Saybrooke Station
Central Illinois Elec. & Gas Co.
Stone and Webster Eng. Corp.
Constructing Engineers

Bartlett-Snow coal handling at Rockford

● The illustration above shows the first 30,000 KW unit of a plant which is to be extended into a 110,000 KW station. All coal handling equipment including track hopper and grill, duplex feeder, conveyors, galleries, chutes, tripper and all supporting structures were fabricated in our shops, and installed by us, to Stone and Webster's plans. For efficiency, satisfaction, and fixed unit responsibility, let the Bartlett-Snow coal handling engineers, with their long experience and complete facilities work with you on your next job.

DESIGNERS
ENGINEERS

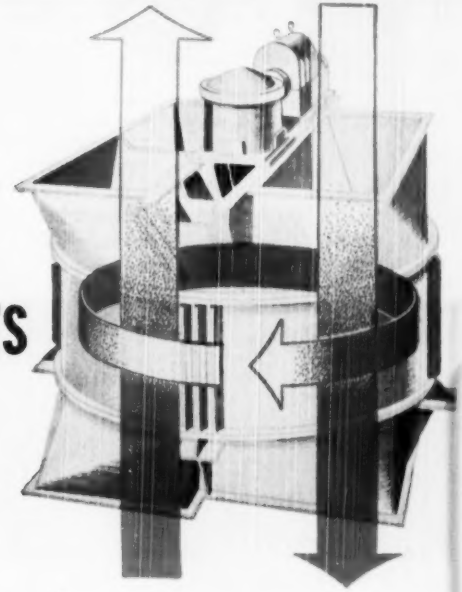
BARTLETT-SNOW
CLEVELAND 5, OHIO

FABRICATORS
ERECTORS

Belt Conveyor from
Track Hopper to Crusher House

View of Crusher House and
Stocking Out Conveyor

How the Ljungstrom Air Preheater can modernize "middle age" boilers



The lightness and compactness of the Ljungstrom Air Preheater makes installation possible on "middle age" boilers with minimum change in the existing structure. This addition of the Ljungstrom Air Preheater, with its continuous regenerative counterflow principle permits operation at lower exit gas temperatures . . . assuring increased heat recovery and reducing the amount of fuel required.

In a matter of a few years the Ljungstrom Air Preheater will effect savings that will more than offset the initial installation cost. If you are interested in approaching modern performance standards with your "middle age" boilers, our engineers will welcome the opportunity to show you how the Ljungstrom can raise the overall efficiency of your plant.

The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves the heat is transferred from the waste gases to the incoming cold air.

THE AIR PREHEATER CORPORATION

60 East 42nd Street, New York 17, N. Y.

For Noise Reduction

Snub the Slug and Stop the Noise

On Engine Exhausts and Compressor Intakes . . . Consult Burgess-Manning Engineers

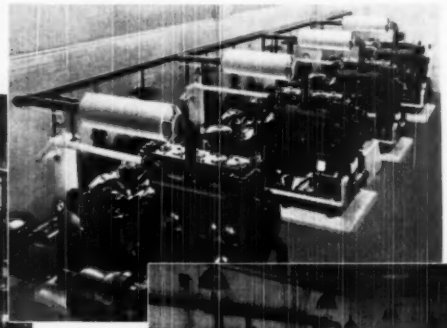
Compressors, blowers, Diesel and other internal combustion engines can be operated anywhere . . . without noise disturbance . . . when you equip them with Burgess-Manning Snubbers. They can also be used to control gas surging and the harmful vibration of machinery and piping produced by such pulsations. Snubbers prevent noise by smoothing the intake air and dissipating the energy in the exhaust gas slugs, providing quiet operation without affecting performance.

For solution of your noise problems, consult the Burgess-Manning engineers.

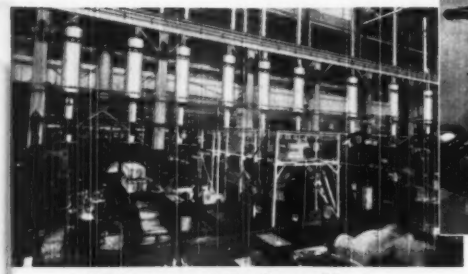
BURGESS-MANNING COMPANY
LIBERTYVILLE, ILLINOIS

INDUSTRIAL

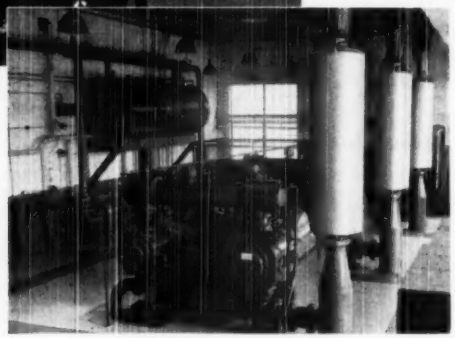
Factories, test stands, hotels



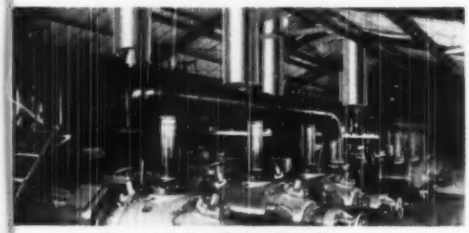
Pumping plant. Four Burgess-Manning Exhaust Snubbers employed.



Engine test stand. Ten Burgess-Manning Snubbers installed.



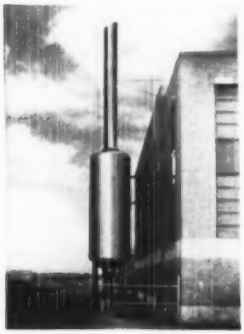
Compressed air system installation



Gas storage installation. Four Burgess-Manning Snubbers employed.

UTILITIES

Power Plants, Water Systems



Electric power plant equipped with Burgess-Manning Snubbers.

OIL FIELD

Drilling, Pumping, Recycling, Refineries

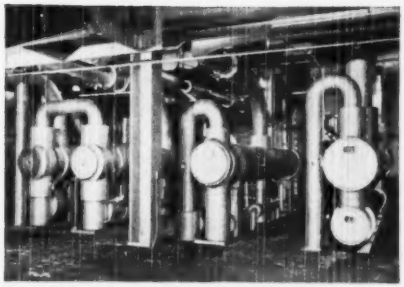
Burgess-Manning Snubber on pipe line gathering engine.

A QUIET SPOT FOR TELEPHONING

Burgess-Manning Acousti-Booth

five examples of

EFFICIENT HEAT TRANSFER EQUIPMENT

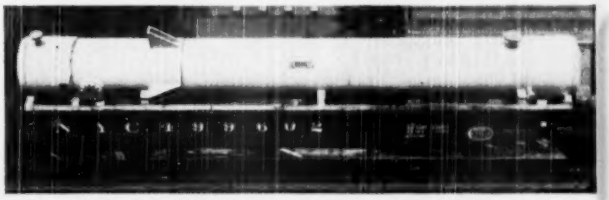


LUMMUS FEED WATER HEATERS and HEAT EXCHANGERS—Left to right, this installation consists of (a) *high pressure feed water heaters*: design pressure of 1,100 psi, tested at 2,200 psi on the tube side—effective surface areas, 935 and 1,355 sq. ft. respectively; (b) *intermediate-pressure heater*, with effective surface area of 1,310 sq. ft.; (c) *low-pressure heater* effective surface 1,750 sq. ft.

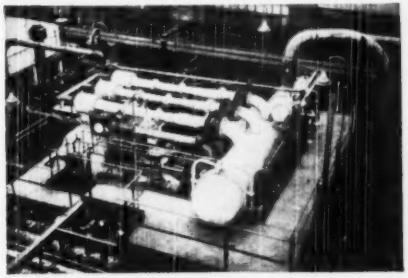
To serve most efficiently in power, refinery, or process plant, heat-transfer equipment must combine enlightened design with superior materials and high-calibre workmanship. Just such a "formula" is realized in each of these five units, representing some of the many types of equipment which Lummus designs and builds to help raise the output and lower the costs of industry.

Lummus, which operates its own manufacturing plant, has an unusually valuable background of experience to apply to your heat exchanger requirements. Throughout the world, Lummus units are operating economically through wide temperature ranges and pressures varying from near-total vacuum to 4,000 psi.

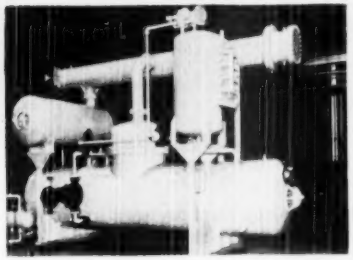
Special-design or standardized, the best formula for efficient heat transfer in your plant is "designed and built by Lummus."



LUMMUS MULTILOK CLOSURES—This catalyst reactor is one of many types of high-pressure equipment with Lummus patented Multilok Closures. These trouble-saving, cost-saving closures are used on feed water heaters and on refinery, chemical, and general industrial high-pressure units with both stationary and floating heads.



LUMMUS STEAM JET REFRIGERATION UNIT—This 350-ton unit, shown before insulation and painting, is installed in the wax de-oiling unit of a large modern refinery. Furnished complete with surface-type condensers and all control equipment, this Lummus unit is arranged so that any single booster or balanced combination of boosters can be operated at reduced tonnage.



LUMMUS EVAPORATORS—Lummus kept this package unit within space limitations by mounting the deaerating feed preheater, the evaporator condenser, the condensate receiver, and the control equipment all on common supports with the evaporator. Evaporators of this type are continuously producing vapors with less than 1.0 p.p.m. solids content when the total solids in the shell liquid is maintained at 3,000 p.p.m.

THE LUMMUS COMPANY
Heat Exchanger Division
385 Madison Avenue, New York 17, N. Y.

LUMMUS

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Detroit • Ft. Worth • Houston • Minneapolis • Pittsburgh
Rochester • St. Louis • San Francisco • Wayne (Phila.)
Athens • Buenos Aires • Honolulu • London • Manila
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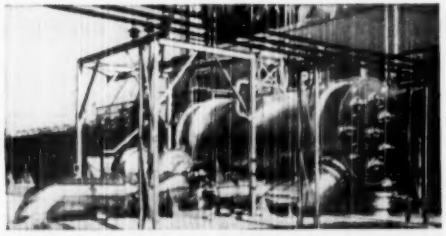


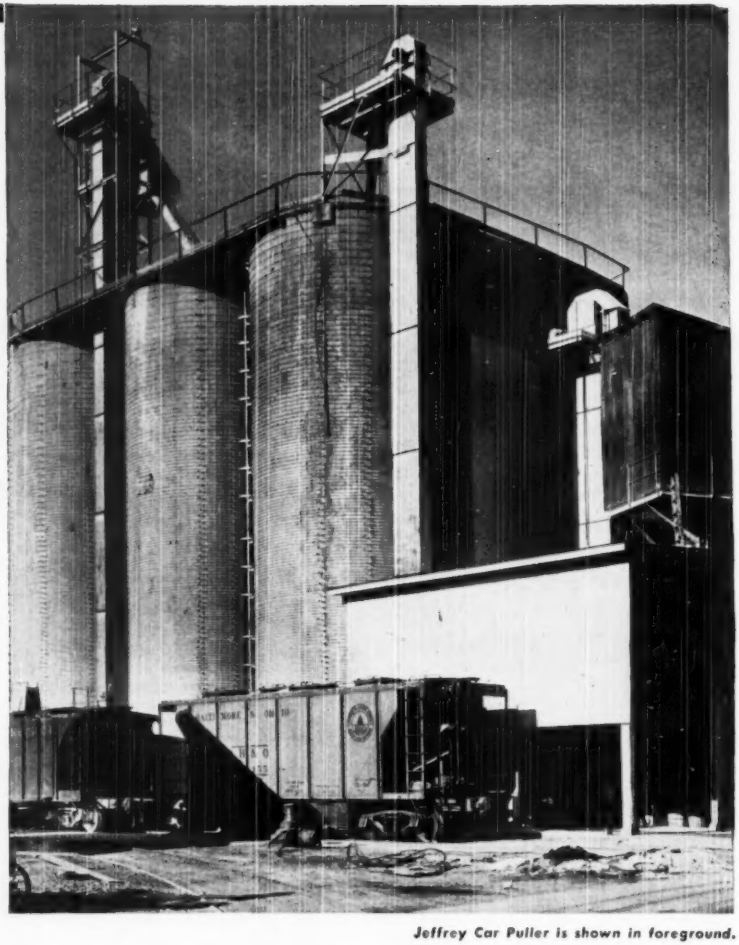
LUMMUS CONDENSERS—This 27,500-square-foot, 2-pass, nondivided waterbox-type surface condenser is a part of a Lummus installation for a southern utility. It was furnished complete with 2-stage, twin-element air ejector and single-stage priming ejector.

LOOK TO LUMMUS for Steam Surface Condensers • Evaporators • Feed Water Heaters • Boiler Blowdown Heat Exchangers Steam Jet Air Ejectors • Steam Jet Refrigeration • Barometric Condensers • Heat Exchangers • Process Condensers • Reboilers Steam Generators (Indirect Fired) • Fuel Oil Heaters • Lubricating Oil Coolers • Pipe Line Coolers • Jacket Water Coolers

JEFFREY BUCKET ELEVATORS

New Improved Design

- Welded Angle Casings —heavy gauge steel Dust tight—Water tight
- Improved Head and Boot Sections
- Increased Bearing Protection
- Removable Hood
- Large Clean-out Doors both sides
- Large Inspection Doors for access to chain and buckets
- Take-ups furnished for Head or Boot if desired—self-aligning, plain or anti-friction bearings



Jeffrey Car Puller is shown in foreground.

These are only some of the features incorporated in our Standard Bucket Elevator line. A type and size to meet any requirement. Complete drawings available. Jeffrey Bucket Elevators are backed by years of engineering experience and hundreds of installations. May we hear from you?

Chains • Conveyors of all kinds • Feeders • Car Pullers • Bin Valves • Dryers and Coolers • Packers • Skip Hoists Screens • Crushers and Pulverizers Belt Idlers • Transmission Machinery Replacement Parts

THE JEFFREY MANUFACTURING COMPANY

Established 1877

814 North Fourth St., Columbus 16, Ohio

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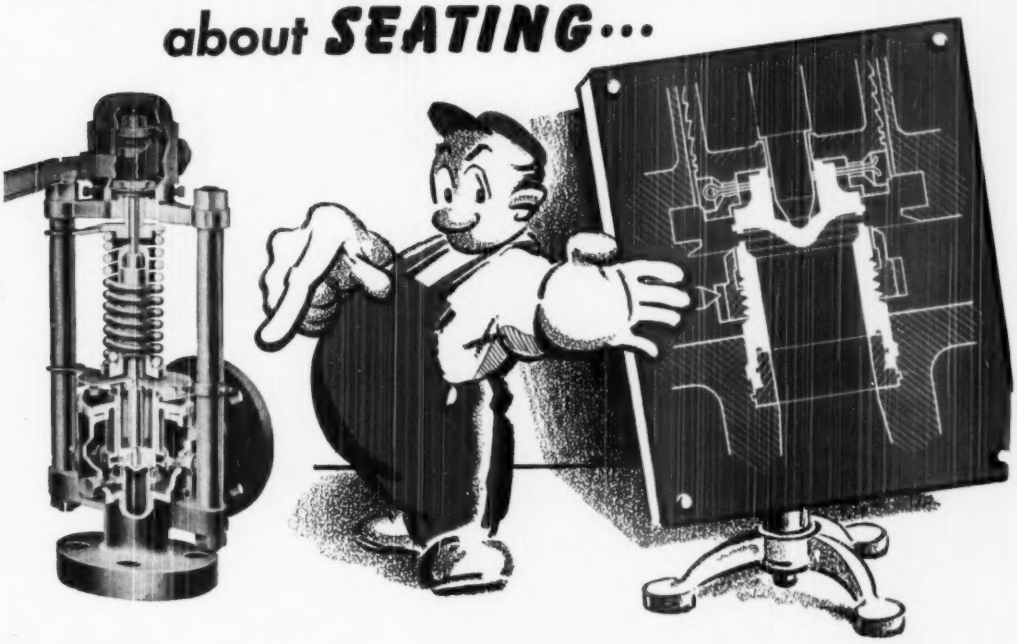
Jeffrey Mfg. Co., Ltd., Head Office & Works: Montreal

Complete Line of Material Handling, Processing and Mining Equipment

We Studied SAFETY VALVE LEAKAGE

— Here's what we found out about SEATING...



We found — what most power plant men already know...that in order to be tight, a safety valve must have matched, wear resistant, corrosion resistant seating surfaces, and that the disc must seat square.

We found — what power plant men have long suspected...that uneven expansion, causing dragging of one seating surface over the other, can destroy the seat so completely that the safety valve has to be overhauled or replaced, even though it has never been popped.

We found ...that when nozzle and disc are made of alloys with the same coefficient of expansion, and with sections designed so that their rate of heat absorption is the same, destructive drag is eliminated. This is one of the basic features of the Gentzel Design, and is the reason Foster 38-SV Safety Valves can be guaranteed to stay tight.

To you ...this means elimination of costly boiler outage due to safety valve leakage. Other guaranteed and proven advantages are...consistently accurate popping ...minimum blow-down, which can be held to as little as 1%...highest relief capacity for a given nominal valve size...and extremely low maintenance.

One Executive of a large Eastern Utility put it this way, "Leakage is a serious item. Every time we have to shut down for leaky safety valves, we tie up several million dollars worth of equipment. It costs us thousands of dollars a day."... The Superintendent of a mid-west generating station said, "My Foster 38-SV's are the only safety valves I have that don't leak."

Foster 38-SV Gentzel Design Safety Valves are made for pressures as low as 35 pounds as well as for pressures in excess of 2500 pounds. For details on the design and construction features that enable this valve to outperform ANY other safety valve... and for a list of installations near you, get in touch with your Foster Representative or with us direct.

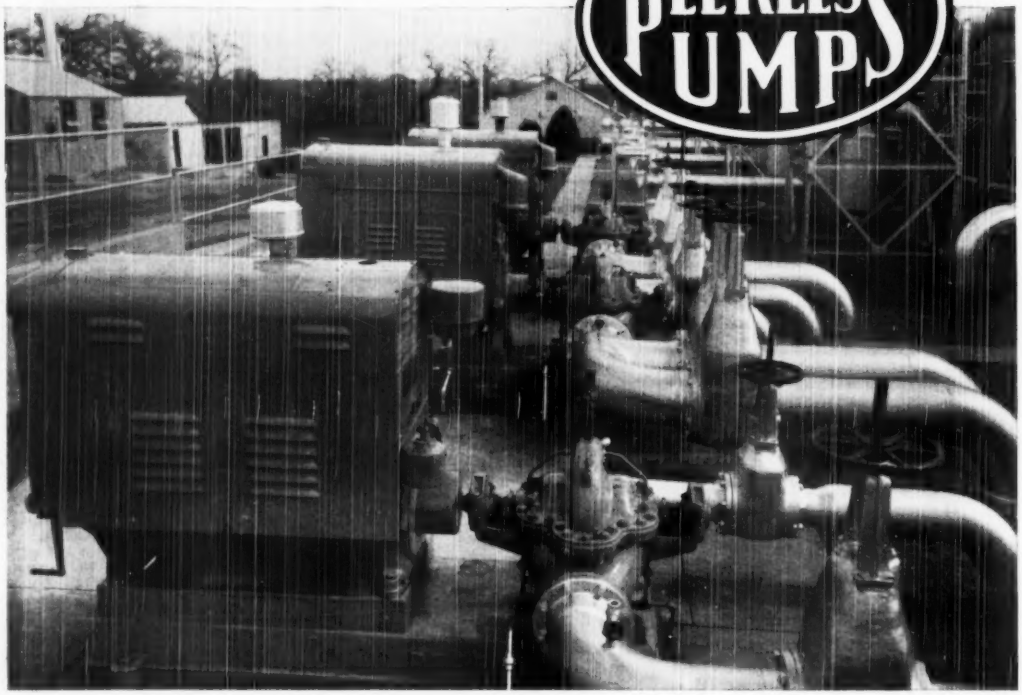
FOSTER ENGINEERING Company

PRESSURE REGULATORS...RELIEF AND BACK PRESSURE VALVES...CUSHION CHECK VALVES...ALTITUDE VALVES...FAN ENGINE REGULATORS...PUMP GOVERNORS ...TEMPERATURE REGULATORS...FLOAT AND LEVER BALANCED VALVES...NON-RETURN VALVES...VACUUM REGULATORS OR BREAKERS...STRAINERS...SIRENS SAFETY VALVES FLOW TUBES

835 LEHIGH AVENUE • UNION, N. J.

PEERLESS PUMPS PREFERRED

VERSATILE CONTINUOUS-DUTY GENERAL PURPOSE TYPE A PEERLESS PUMPS



Peerless Type A Horizontal Centrifugal Pumps Used in Gas Booster Station for Handling Jacket Cooling Water

Peerless Type A general purpose horizontal centrifugal pumps are preferred by this large producer of natural gas, for a host of reasons. Here are a few of the features that contribute to their unsurpassed performance:

1. Employ duplex angular contact thrust bearings for longer life and lower maintenance cost, under heavy continuous or intermittent duty.
2. Bearing housings have double-wall construction; first, to insure against any distortion of ball race and second, to provide water-cooling space between walls.
3. Impeller rings are generously wide and grooved; efficiency is increased by minimizing leakage between suction and discharge chambers.
4. Heavy case rings, with ribs on both ends, provide extra strength, prevent distortion and effect a seal against leakage.
5. Shaft sleeves, locked against direction of rotation by right and left hand threads at impeller hub, prevent shaft distortion when handling hot liquids.
6. Incorporate five rows of heavy duty packing and utilize an in-and-out water seal connection for use when handling hot liquids.

These general purpose pumps are completely described in Peerless Bulletin B-1300. Write for your copy.

TYPE A PUMP CHARACTERISTICS

CAPACITIES: Up to 70,000 GPM
HEADS: Up to 300 Ft.
SIZES: 1¼" to 48"
LIQUID TEMPERATURES: Up to 300° F
SINGLE STAGE—DOUBLE SUCTION
HORIZONTAL SPLIT CASE

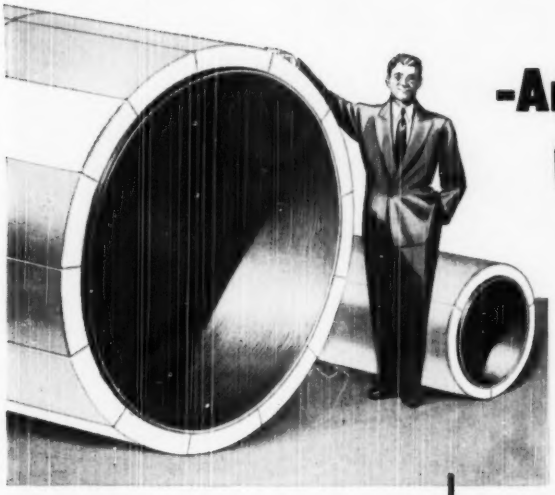
•

APPLICATIONS:

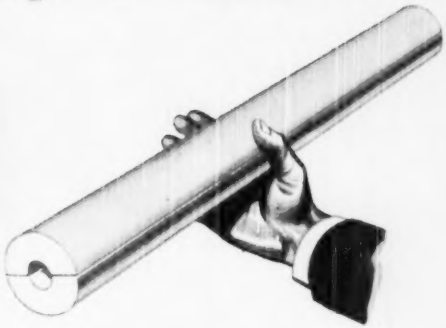
BOOSTER STATIONS
WATER SUPPLY
COMMERCIAL BUILDINGS
INDUSTRIAL PROCESSING
WASTE DISPOSAL
COOLING AND REFRIGERATION
FIRE PROTECTION

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
Factories: Los Angeles, California, and Indianapolis, Indiana.
Offices: New York, Atlanta, Chicago, St. Louis, Phoenix, Fresno, Los Angeles, Dallas, Plainview and Lubbock, Texas; Albuquerque, N. M.

ONE PIPE INSULATION FOR PIPE SIZES ½ TO 72 INCHES



-And Temperatures Up to 1200° F.



SECTIONAL
Pipe sizes from ½" to 12".

TRI-SEGMENTAL
Pipe sizes from 8" to 23".

QUAD-SEGMENTAL
Pipe sizes from 19" to 41".

K-SEGMENTAL
For pipes, vessels or tanks from 38" to 72" in diameter.

KAYLO PIPE INSULATION is produced in Simplified Dimensional Standards of thicknesses, diameters and shapes for snug nesting, when necessary. O. D.'s of insulation correspond to O. D.'s of standard pipes. All sections are 36 inches long. Single-layer thicknesses range from nominal 1" through 4".

Here is one proved pipe insulating material that is efficient throughout a wide temperature range—up to 1200°F. Kaylo Pipe Insulation is a calcium-silicate material which is highly resistant to damage from water vapor or moisture. It retains its dimensional stability and efficiency in long service. It is not a glass product.

Kaylo Pipe Insulation is available for pipe sizes from ½ inch to 72 inches. It is made to close dimensional tolerances to assure proper fit for each pipe size and for all operating conditions. Higher strength and lighter weight make it easier to handle and apply.

It will pay you to investigate all of the advantages offered by Kaylo Pipe Insulation. Get the facts now.

KAYLO®

PIPE INSULATION AND HEAT INSULATING BLOCK

OWENS-ILLINOIS GLASS COMPANY
Kaylo Division • Toledo 1, Ohio

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SEND COUPON FOR KAYLO HEAT INSULATION LITERATURE

OWENS-ILLINOIS GLASS COMPANY
Dept. N-74, Kaylo Division • Toledo 1, Ohio

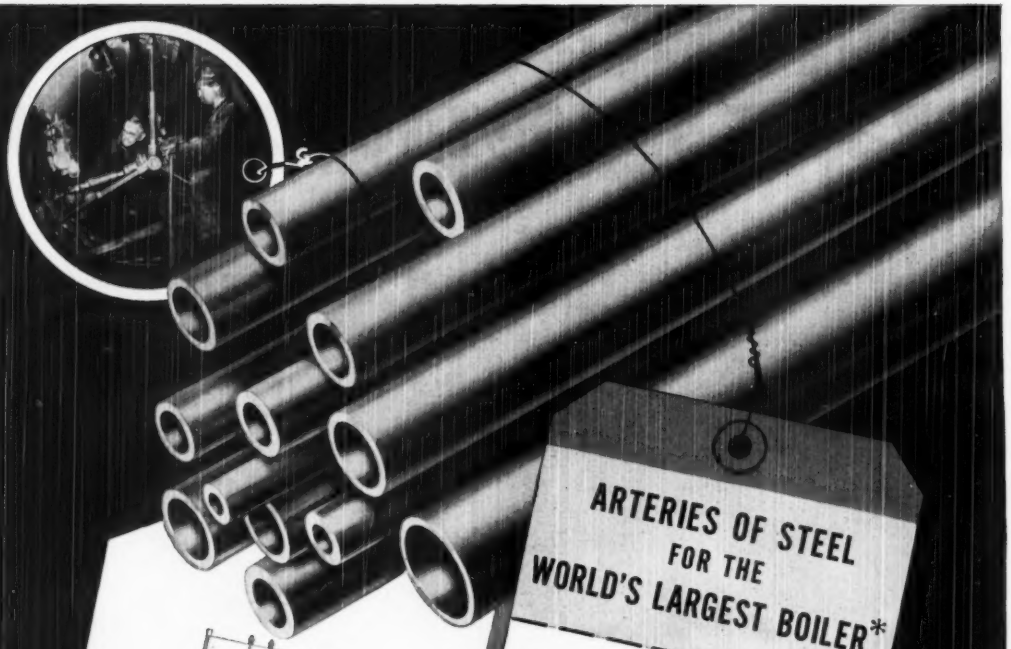
Gentlemen: Please send me descriptive literature on Kaylo Heat Insulation.

NAME .....

FIRM .....

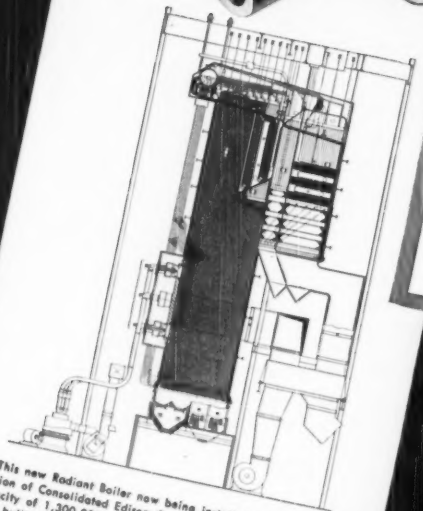
ADDRESS .....

CITY ..... STATE .....



ARTERIES OF STEEL
FOR THE
WORLD'S LARGEST BOILER*

314,800 FT. OF
B&W
BOILER TUBES



* This new Radiant Boiler now being installed at Hudson Avenue Station of Consolidated Edison Co. in New York City has a steam capacity of 1,300,000 lb. per hr. . . . the largest capacity unit ever built. It is completely tubed with B&W carbon, alloy, and stainless tubing.

Quick service on your boiler tube requirements is available through your nearest B&W Tube Representative and through local distributors in principal cities.

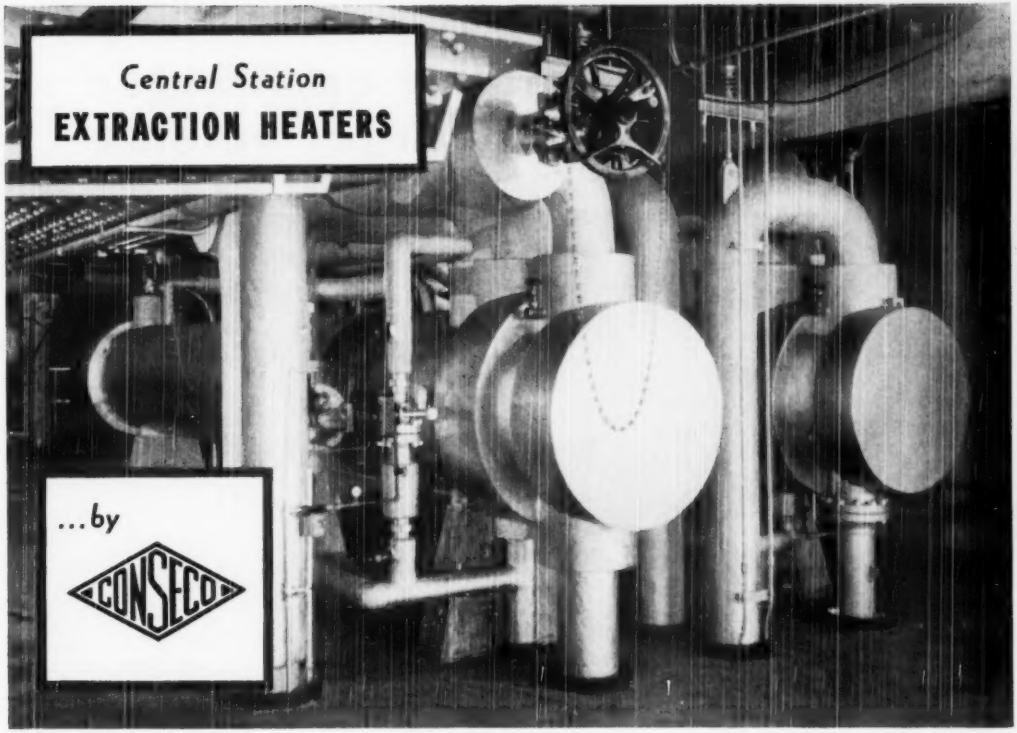
SAY B&W BEFORE YOU SAY BOILER TUBES
. . . for long-term service satisfaction and economy

THE BABCOCK & WILCOX TUBE COMPANY
General Offices: Beaver Falls, Pa. Plants: Alliance, Ohio, and Beaver Falls, Pa.
Sales Offices: Alliance, Ohio • Beaver Falls, Pa. • Boston 16, Mass.
Chicago 3, Ill. • Cleveland 14, Ohio • Denver 2, Colo. • Detroit 26, Mich.
Houston 2, Texas • Los Angeles 15, Calif. • New York 16, N. Y. • Philadelphia 2, Pa.
St. Louis 1, Mo. • San Francisco 3, Calif. • Syracuse 2, N. Y.
Toronto, Ontario • Tulsa 3, Okla. • Vancouver, British Columbia

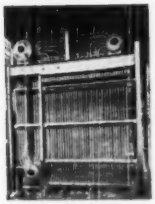
B&W SEAMLESS and WELDED TUBES

TA-1520 C

Central Station
EXTRACTION HEATERS



...by CONSECO



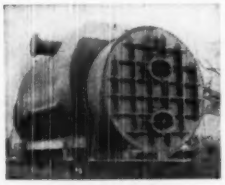
BOILERS

EVAPORATORS

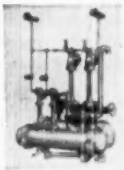
The two Feed Water Heaters here shown are installed in the central power station of a large New England public utility company. Each unit is a low pressure, internal floating head, removable-bundle type. These units embody design features which are the result of CONSECO'S long, successful experience in the development of heat exchange equipment.

The larger of the two units has 3,000 sq. ft. of surface, uses extraction steam, and handles 380,000 lbs. of water per hour. The smaller, 2500 sq. ft. unit is fitted with an integral drain cooler and handles 435,000 lbs. of water per hour, using extraction steam. Liquid level in the drain cooler section is automatically controlled.

DEAERATORS



CONDENSERS



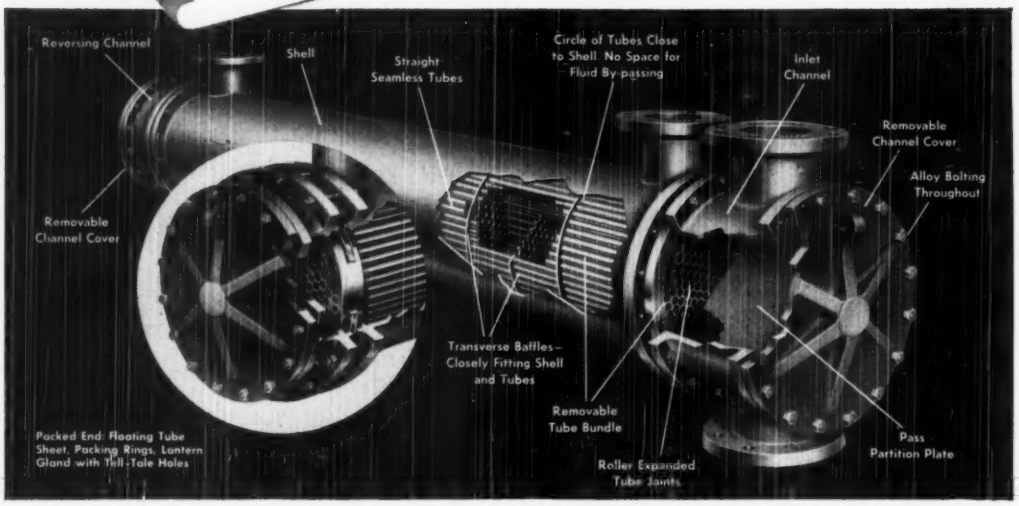
STEAM JET AIR EJECTORS

REFINER FILTERS

It will be to your advantage to consult with CONSECO Engineers on your requirements. Their highly specialized experience and close cooperation can be of valuable assistance to you.

CONSECO **Condenser Service & Engineering Co.**
HOBOKEN, N. J.

now a smaller exchanger to handle a larger volume


Reversing Channel
Shell
Straight Seamless Tubes
Circle of Tubes Close to Shell. No Space for Fluid By-passing
Inlet Channel
Removable Channel Cover
Alloy Bolting Throughout
Removable Channel Cover
Transverse Baffles—Closely Fitting Shell and Tubes
Removable Tube Bundle
Pass Partition Plate
Roller Expanded Tube Joints
Packed End: Floating Tube Sheet, Packing Rings, Lantern Gland with Tell-Tale Holes

Ross Research Reduces Size-Cost Requirements For Many Installations

For years, one of industry's most widely used, removable bundle exchangers, Ross Type CP now offers still more heat transfer capacity without increase in size.

As a result, it is possible in many instances for a smaller, less costly exchanger to handle a volume formerly calling for a larger unit.

MORE TRANSFER SURFACE — INCREASED TRANSFER RATE

A new tube layout, incorporating an added circle of tubes close to the shell (in the space so frequently left open in conventional designs) not only increases surface, but improves flow characteristics. Moreover, new techniques achieve closest possible clearances with utmost accuracy and uniformity, adding substantially to heat transfer rate.

LOW FIRST COST — QUICK DELIVERY

Add savings in space and cost, to the already well known benefits of low purchase price and quick delivery made possible through standardization and stocking of parts, and it's easy to see why Ross Type CP, now more than ever, is industry's leading removable tube bundle type exchanger.

FREE CATALOG

Get details on these and other famous Ross features such as easy-to-clean, straight tube design . . . wide latitude of connection locations . . . ease of installation . . . in new file-size Bulletin 2.1K1. Write.

ROSS HEATER & MFG. CO., INC., Div. of American Radiator & Standard Sanitary Corp., 1415 West Ave., Buffalo 13, N. Y. In Canada, Horton Steel Works, Limited, Fort Erie, Ont.

ROSS

EXCHANGERS

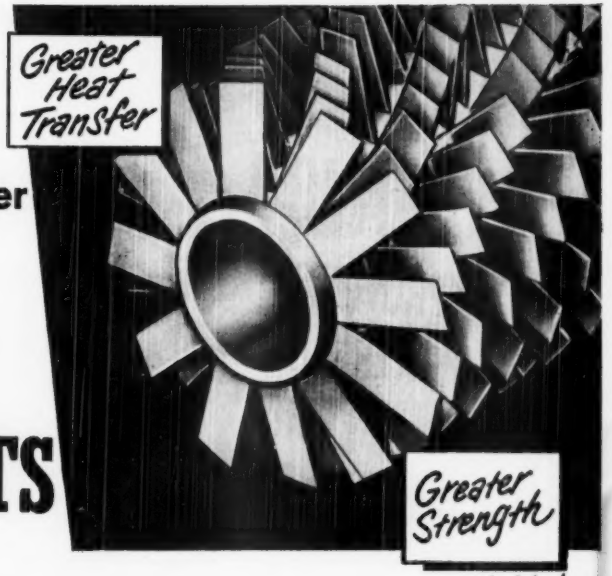
Serving home and industry

AMERICAN STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON

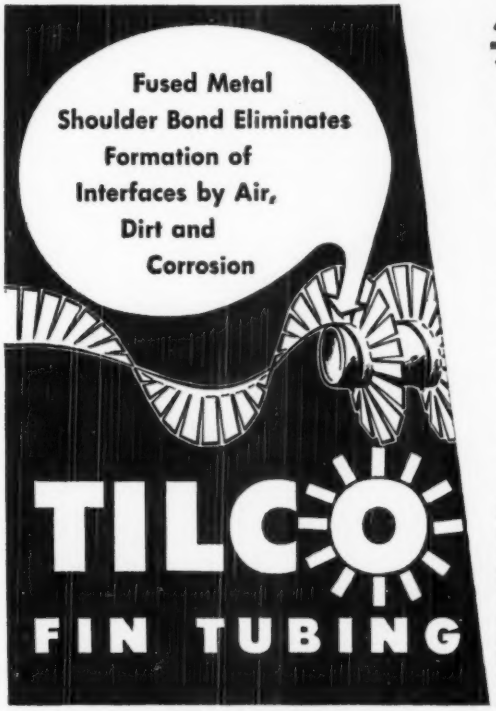
NOW!

Exclusive Fin-Shoulder Bonding

LOWERS STEAM COSTS



Only TILCO Strip Fin Tubing is SHOULDER BONDED by Welding



TILCO-FIN DIVISION
David E. Kennedy, Inc., Brooklyn, N. Y.

Fin tubing is the modern way to cut high steam costs. But now Tilco exclusive features can make your steam costs drop *even more.*

Here is why: Tilco is the only strip fin tubing *shoulder bonded* by resistance welding, soldering or brazing. Its full 1/8" shoulder makes possible (1) a fused metallic bond that eliminates 3 big causes of heat transfer loss...the formation of interfaces by air, dirt and corrosion, and (2) it imparts such increased strength to the fin bond that it will not break under any conceivable service condition.

Flexible Application

Tilco's own specially designed manufacturing equipment provides flexibility that can give you a "tailor made" installation. Wide range of metals...steel fin welded to steel tube ...stainless steel fin welded to stainless steel tube...steel fin welded to cupro-nickel tube and many others. Fin spacing from 2 to 16 fins per inch...fin heights from 1/8" to 2"...tube diameters from 1/2" to 6".

Mail the coupon today for a free sample or to have a representative call. You will learn why fin tubing reaches the most advanced point of effectiveness in "Shoulder Bonded" Tilco-Fin Tubing.

Dept. G

TILCO-FIN DIVISION, David E. Kennedy, Inc.
58 Second Avenue, Brooklyn 15, N. Y.

I want to know more about "Shoulder Bonded" Tilco-Fin Tubing and how it will lower steam cost more than ordinary fin tubing. I understand there is no obligation.

1. *Have a representative call* ☐
2. *Send me a free sample* ☐ Please Check

NAME_____

FIRM NAME_____

BUSINESS ADDRESS_____

CITY_____ STATE_____

NAVCO
PROVIDES THE
POWER ARTERIES
IN THIS
CENTRAL STATION
Just another modern High Pressure-High Temperature Power Plant in the Southwest that has DEPENDABLE Piping.
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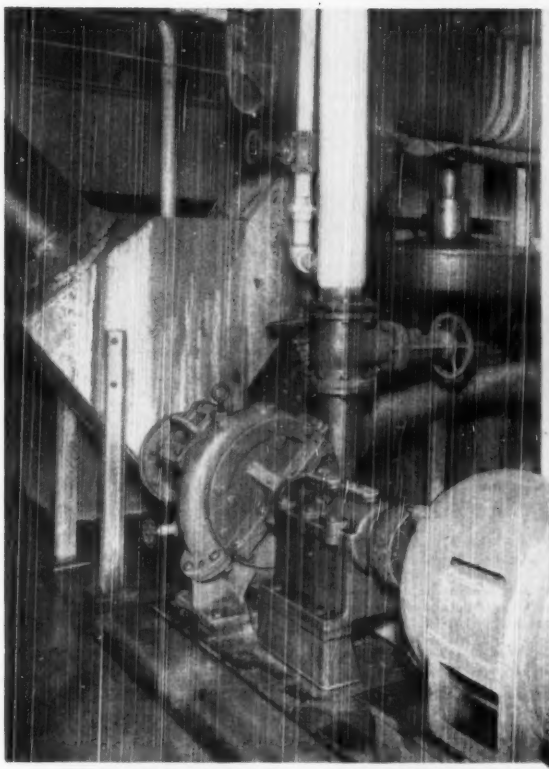
NATIONAL VALVE & MANUFACTURING COMPANY • PITTSBURGH, PA.
NEW YORK • CHICAGO • CLEVELAND • BOSTON • ATLANTA • TULSA • BUFFALO • CINCINNATI

Hi Neighbor! Power Plant or Process—

There's a WARREN PUMP

engineered to your job!



For instance, Narragansett Brewing Company, New England's largest brewery, had a problem in the handling of spent grain which was solved by the installation of special Warren Pumps. These pumps were engineered and built for pumping pulpy materials of various densities and having properties which render them unsuitable for handling with most types of pumps.

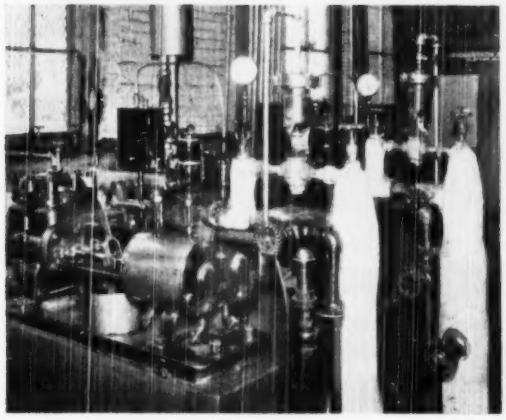
In the power plant at Narragansett, Warren Pumps are also on the job, including both steam and centrifugal and on Fuel Oil Service, Condensate, General Water Supply, etc., etc.

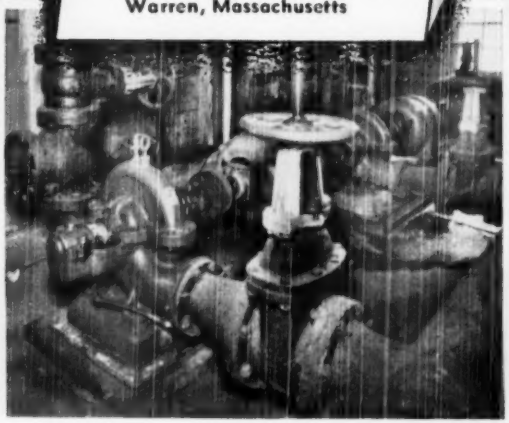
Perhaps you have a pumping problem, too . . . one that cannot be best solved by an "off-the-shelf", conventional type of pump. If so, calling in a Warren Pump Specialist may result in the right answer . . . and substantial savings in production costs. P24

Warren Pumps

Warren Steam Pump Co.

Warren, Massachusetts





Specify Honan-Crane

OIL PURIFIERS FOR UTILITIES AND POWER PLANTS

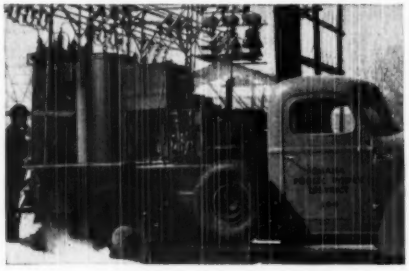
"R"

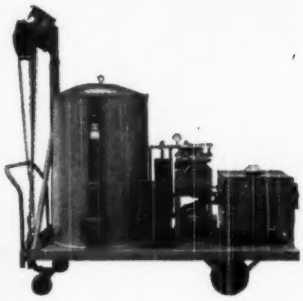
Specify

Honan-Crane "R" Type Purifier for INSULATING OILS

Consistent Honan-Crane purification removes acids, moisture and sludge from insulating oils in transformers and circuit breakers. Protects equipment . . . reduces power failures . . . pays for itself in lowered maintenance costs.

Honan-Crane "R" Type Mobile Purification Unit is first choice among utilities and power plants requiring capacities of 100 to 200 GPM. Ideal for use in the field or at a central station. *For complete information, write for Bulletin "R".*





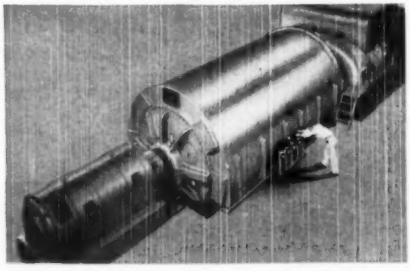
Two Honan-Crane "R" Type Purifiers are used by Omaha Public Power District to maintain oil in more than 1,000 transformers in 300 substations . . . as well as large banks of transformers and about 200 small units at the power plant itself.

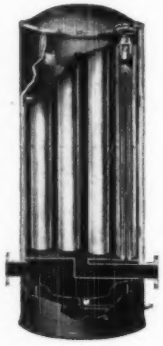
"M"

Specify

Honan-Crane "M" Type Purifiers for TURBINE and DIESEL OILS

Honan-Crane "M" Type Purifier is low-cost protection from the abrasive and acid action of contaminated oil. High-flow, multiple cartridge "M" Type unit maintains oils in original clean, safe condition . . . keeps neut. number and steam emulsion number within desired limits. Design permits easy change-over from Palconia cartridges (cellulose fiber) for removal of solid contaminants and abrasives . . . to Cranite cartridges (specially processed fullers earth) for removal of suspended fines and products of oxidation (asphaltenes, acids, gums and resins). *For complete information, write for Bulletin "M".*





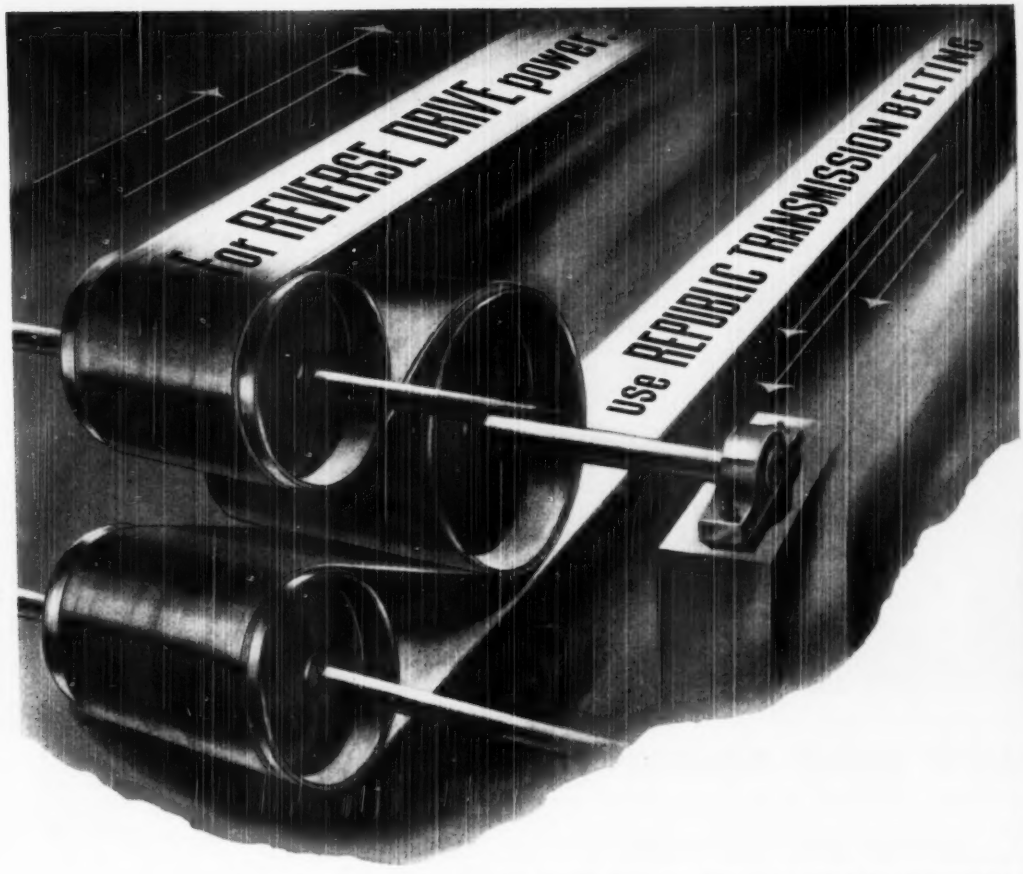
The Ohio Public Service Company has used Honan-Crane oil purification equipment continuously for many years . . . now has Honan-Crane installed in five of its big Ohio generating stations which produce a total of 470,000 kilowatts.

For Equipment Bulletins and full information on Honan-Crane Oil Purifiers and Handling Equipment, write to . . . . . .

HONAN-CRANE CORPORATION

100 SUPERIOR AVENUE, LEBANON, INDIANA

A Subsidiary of **HOUDAILLE-HERSHEY CORP.**



Directional reverses come with machine gun speed for the transmission belt shown above. It's Republic's Challenger Belting on a reverse power drive installation at Stantonsburg Lumber Company, Stantonsburg, North Carolina.

Constant reverse flexing like this is tough on any belt, yet Republic's Challenger, now in its third straight year of continuous service, shows no signs of tiring.

Of course, Republic Challenger Transmission Belting is designed for heavy industrial drives where shocks and stresses are encountered, and is also perfectly suited to high-speed drives operating over small pulleys.

Challenger is a *pre-stretched* belt that doesn't loosen when pulling extra heavy loads. It's a belt that's free from fastener trouble because it is built with hard-woven duck. All edges are sealed against moisture.

Ask your local Republic Distributor about Challenger Belting today or write direct for information. Standard widths and plies are available in both roll or endless lengths. Both top and bottom surfaces have non-slip friction for better pulley traction.

See Your Local Republic Distributor

Close contact with experts like the Taylor Parker Company, Republic's Distributor in Norfolk, Virginia, who installed this Challenger Transmission Belt, assures success in industrial rubber applications. Contact your local Republic Distributor now about all your problems in . . . . HOSE, BELTING, PACKING and EXTRUDED and MOLDED RUBBER PRODUCTS.

INDUSTRIAL RUBBER PRODUCTS BY

REPUBLIC RUBBER DIVISION

Lee Rubber & Tire Corporation

YOUNGSTOWN, OHIO

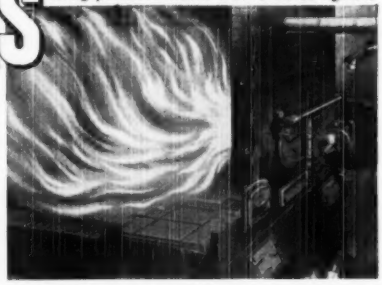
IRON FIREMAN Pneumatic Spreader STOKER

The Iron Fireman Pneumatic Spreader stoker distributes pre-heated coal evenly over entire grate area. Fines burn in suspension; larger pieces form shallow fuel bed. Exceptionally responsive to load changes.

with quick change to OIL or GAS

Protect your boiler plant against high fuel prices or shortages

For oil firing, the Pneumatic Spreader stoker nozzle is removed and the Iron Fireman rotary oil burner is swung into firing position. Burns No. 6 oil or lighter.



The Iron Fireman ring type gas burner surrounds the same firing port used for both coal and oil. Fires natural or mixed gas with either forced or natural draft.

With Iron Fireman firing you can switch readily from one fuel to another. The Iron Fireman gas-oil-coal combination fires all three fuels from the same port in the boiler front. Fuel change is accomplished in a short time without major alterations. For short emergency firing periods fuels can be switched in a few minutes.

Advantages are obvious. Your plant can benefit from seasonal price changes in the different fuels. You have standby equipment to meet almost any conceivable fuel emergency. You do not sacrifice efficiency in changing fuels, for all three burners are engineered for the job, with Iron Fireman quality and dependability through and through.

For further information write to Iron Fireman Mfg. Co., 3236 W. 106th St., Cleveland 11, Ohio. Other plants in Portland, Oregon; Toronto, Canada. Authorized Iron Fireman dealers throughout the U. S. and Canada.

IRON FIREMAN

Builders of Automatic Heating Equipment for More than 27 Years

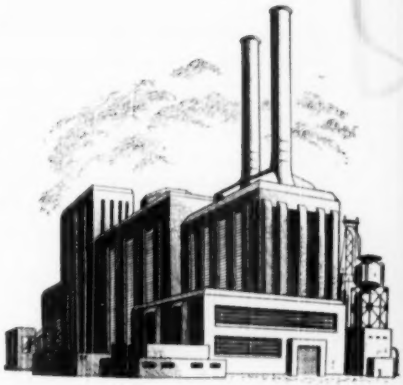
AUTOMATIC FIRING EQUIPMENT FOR COAL, GAS, OIL

STRANGE! *Isn't it?*

THIS ASSEMBLY *was fabricated from 4-6% "chrome-moly" steel pipe . . . by* POWER PIPING DIVISION

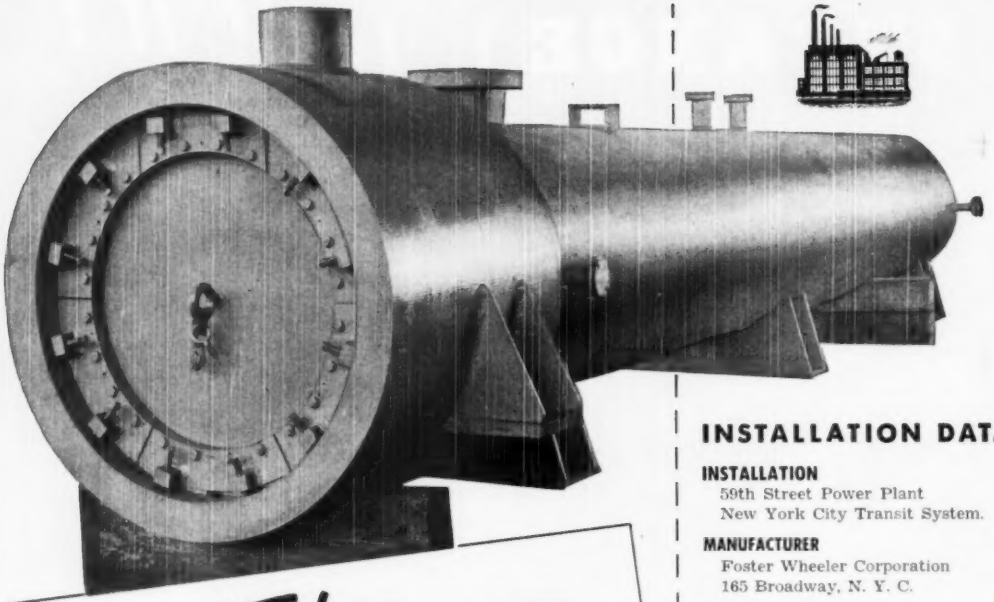
STRANGE SHAPES come from the shops of Blaw-Knox Power Piping Division. Some of these intricate assemblies require great ingenuity—some are easily fabricated because of the long experience and complete equipment available in Blaw-Knox piping plants.

Blaw-Knox Power Piping is built to outlive the plants it serves. Thus uninterrupted long-term service is assured and the prohibitive costs of replacement are avoided.



POWER PIPING DIVISION
OF BLAW-KNOX CONSTRUCTION COMPANY
1525 Pennsylvania Avenue, Pittsburgh 12, Pa.

BLAW-KNOX *Power Piping*



Monel Tubes have many advantages in Boiler Feed-water Heaters

Foster Wheeler Corporation designed and built the above boiler feed-water heater (and a mate) for the 59th Street Power Plant of the New York City Transit System, to specifications set by Burns and Roe, Inc.

And into each heater went 550 Monel® U-tubes . . . *insurance for long, efficient service.*

Here are some of the reasons why Monel was specified in place of more commonly-used metals:

1. Higher mechanical properties . . . which means better heat transfer because lighter gauges can be used.
2. Better all-'round corrosion resistance . . . which means longer life, fewer failures, less "downtime."
3. Greater hardness . . . which means better resistance to erosion and cavitation. And when tubes stay smooth, you get faster flow, better heat transfer.
4. High ductility . . . which means tight rolled joints in tube sheets, and ease of forming bends in U-tube heaters.
5. Easy weldability . . . which means conventional welding techniques can be used to weld the Monel tubes into the steel tube sheet, if welding is specified.

Consider Monel the next time you design, install or re-tube a heater. No other metal offers so many advantages for this use. For more information on Monel heater tubes, write to P. F. Sheridan at Inco.

INSTALLATION DATA

INSTALLATION
59th Street Power Plant
New York City Transit System.

MANUFACTURER
Foster Wheeler Corporation
165 Broadway, N. Y. C.

SPECIFICATIONS
Burns and Roe, Inc.
233 Broadway, New York 7, N. Y.

TUBE DETAILS
Each heater has 550 Monel U-tubes, ⅝" O.D., 17 B.W.G. (.058" wall).

LOCATION
Two of the illustrated, closed-type, Monel-tubed feed-water heaters will be installed between boiler feed pump and boiler. (Three direct contact heaters are in the line before the feed pump.)

OPERATING CONDITIONS
950° F., 1250 psi at turbine throttle.

FIRST-STAGE MONEL-TUBED HEATER
Uses 450 psi, 680° F. bleed steam in shell. Outlet water temperature: 421.4° F.

SECOND-STAGE MONEL-TUBED HEATER
Uses 900 psi, 860° F. bleed steam in shell. Outlet water temperature: 515.1° F.

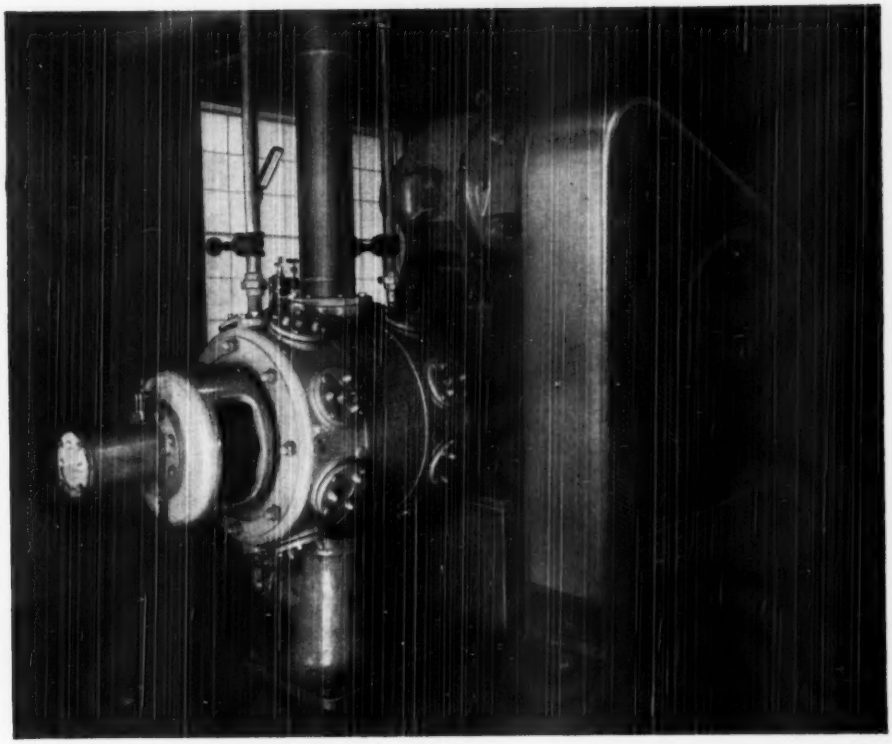
WATER PRESSURE IN HEATER TUBES
2000 psi design.

WATER VELOCITY THROUGH HEATER TUBES
3.97 feet per second.

CAPACITY OF HEATERS
693,000 pounds of water per hour.

EMBLEM OF SERVICE
INCO
TRADE MARK

THE INTERNATIONAL NICKEL COMPANY, INC. • 67 Wall Street, New York 5, N.Y.



oil free air

with this CP Oil-less Compressor

Where it is essential that compressed air be absolutely free from oil, to avoid injury to products, CP Oil-less Cylinder Compressors meet the most exacting requirements.

Piston and rod, completely supported by tail rod and outboard crosshead, are full floating, removing all weight from cylinder wall and stuffing boxes. This assures long life of segmented carbon piston rings, with no need for periodically rotating them.

These compressors are available in a wide range of sizes and ratings; in single and two-stage types; arranged for belt, motor or steam drive.

Write for Bulletin 728-B

CHICAGO PNEUMATIC TOOL COMPANY

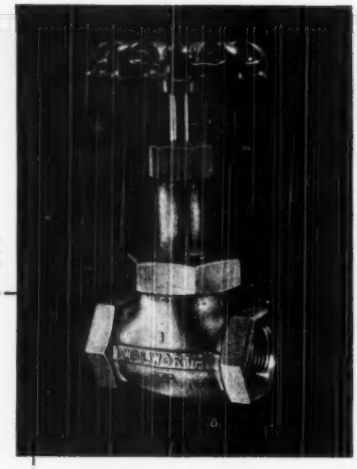
General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

IDENTIFICATION DISC: An aluminum marking plate on all Walworth No. 225P's facilitates inventory control and makes reordering quick and positive.

NEWLY DESIGNED HANDWHEEL: Patented air-cooled, finger-fit handwheel affords sure grip even with greasy gloves.

IMPROVED PACKING: Molded packing of lubricated asbestos reinforced with copper wire. Suitable for practically every service. Valves can be repacked under pressure when fully opened.



take a good look at the Walworth "500 Brinell" no. 225P Globe

– the Toughest Bronze Valve Your Money Can Buy

The stainless steel, corrosion resistant seats and discs are heat treated to a hardness of 500 Brinell – hard enough to scratch glass and crush nails! The valve can be closed on sand, slag, and pipe scale without injury to the seating surfaces. "Wire drawing" is practically eliminated. All parts are accurately machined and gaged. Years of tight, positive shut-off are assured.

Available in both globe and angle types (angle type: No. 277P) in sizes ¼" to 2", this quality valve is recommended for 350 lbs. W.S.P. at 550 F, and 1000 lbs. non-shock service on cold water, oil, gas, or air.

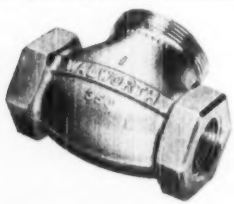
For full data on this long-life, economical Walworth Bronze Valve, see your local Walworth distributor, or write for Circular.

note these 7 Great Features

HEXAGONAL UNION BONNET CONNECTION, DEEP STUFFING BOX AND RUGGED STUFFING NUT: Union bonnet connection eliminates any chance of distortion or leakage even though valve is repeatedly taken apart and reassembled.

OVERSIZE STEM: The high-tensile strength silicon-bronze stem assures long life and protection against wear.

SEATS AND DISCS: Plug type seats and discs of stainless steel, heat-treated to 500 Brinell hardness and machined simultaneously to a mirror-like finish, with accurate tapers assures tight positive shut-off with minimum handwheel effort.



EXTRA STRONG BODY: Made of Composition M (ASTM B61) bronze. Thick walls and rugged hexes provide a high safety factor. Valves undergo hydrostatic shell test of 1,000 psi.

WALWORTH

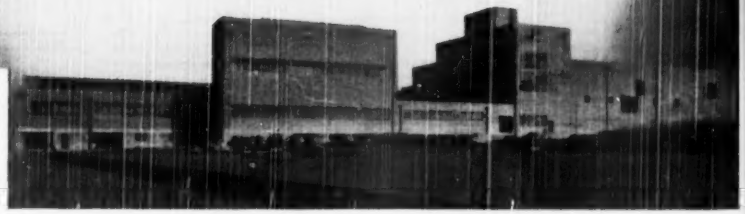
valves and fittings

60 EAST 42nd STREET, NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

Announcing

MUNDET CUSTOM-MOLDED 85% MAGNESIA HEAT INSULATION



Mundet district offices are located in these cities:

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339-41 Elizabeth Street, N.E.
BOSTON
57 Regent St., North Cambridge 40
CHARLOTTE, N. C.
507 S. Cedar St.
CHICAGO 16
2601 Cottage Grove Avenue
CINCINNATI 2
427 West 4th Street
DALLAS 1
601 Second Ave.
DETROIT 21
14401 Prairie Street
HOUSTON 1
Commerce and Palmer Streets
INDIANAPOLIS
15 E. Washington St.
JACKSONVILLE 6, FLA.
800 E. Bay St.
KANSAS CITY 7, MO.
1428 St. Louis Avenue
LOS ANGELES
(Maywood)
6116 Walker Avenue
NEW ORLEANS 16
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856 N. 48th Street
ST. LOUIS 9
3176 Brannon Ave.
SAN FRANCISCO 7
440 Brannan Street
In Canada:
Mundet Cork & Insulation, Ltd.
35 Booth Avenue, Toronto

This new Mundet plant is designed to provide you with superior heat insulation. Its facilities for the manufacture of Custom Molded 85% Magnesia Pipe Covering and Block Insulation are unequalled anywhere in the United States.

Operations are automatic and precision-controlled throughout manufacturing. Specially designed equipment and improved methods contribute to the production of heat insulation that serves more effectively, and at lower life-cost.

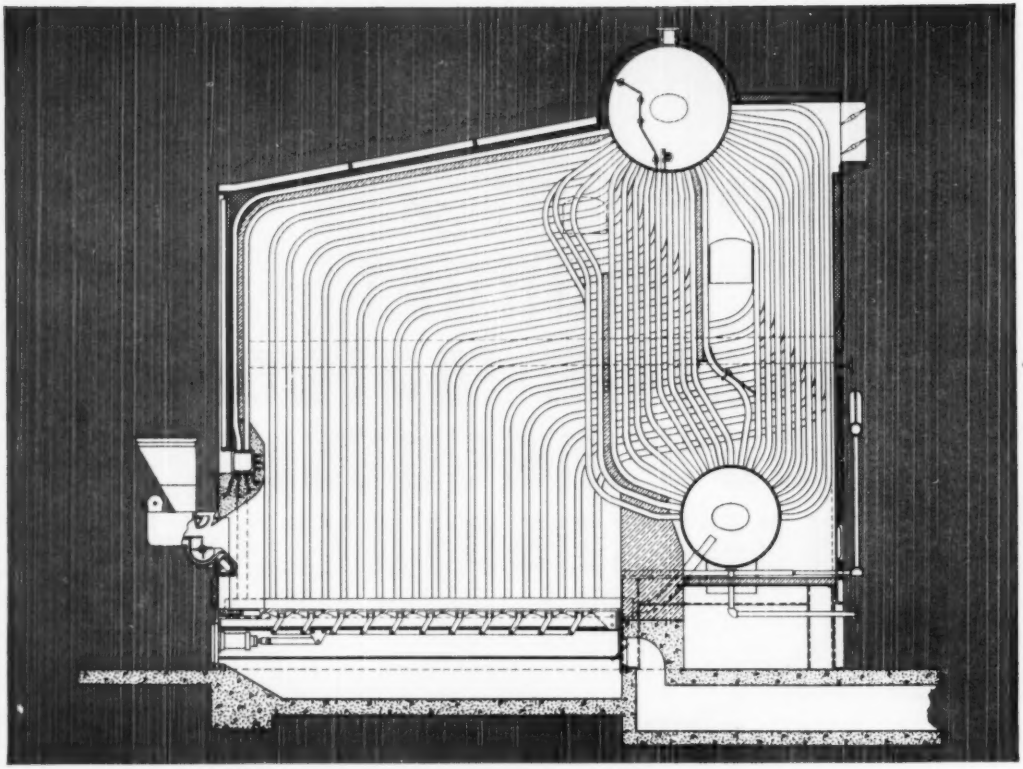
By using Mundet Custom Molded 85% Magnesia Insulation, you benefit from:

- *Greater Heat Saving Efficiency*
- *Controlled Uniformity*
- *Longer Life*
- *Custom Molded Precision Pipe Fit*
- *Attractive, Smooth Finish*

Descriptive folder, with simplified thickness standards, sent promptly on request. Write for it now. Mundet Cork Corporation, Insulation Division, 7107 Tonnelle Ave., North Bergen, N. J.

MUNDET

INSULATION FOR HIGH AND LOW TEMPERATURE



THE *V-C* 2-DRUM *High Capacity • Small Space*

COMBINING BOILER • WATER WALL FURNACE • INSULATED STEEL CASING

ERIE CITY concentrates high capacity into small space. The V-C Steam Generator has complete water cooling of top, sides and front, integral with a 2-drum boiler.

GAS travel is symmetrical about the center line of the unit.

WATER circulation is ring flow.

ONE or two internal steam separators, as required, assure clean, dry steam.

THE entire unit is supported from bottom members, thus allowing free expansion upward of the entire unit. All exterior walls consist of insulated steel panels, independently suspended, a construction similar to that of our largest central station steam generators.

ANY tube can be replaced without disturbing any other tube.

THE above illustration shows an Erie City Spreader Stoker fired V-C unit, utilizing a water cooled plastic arch, molded around the front header.

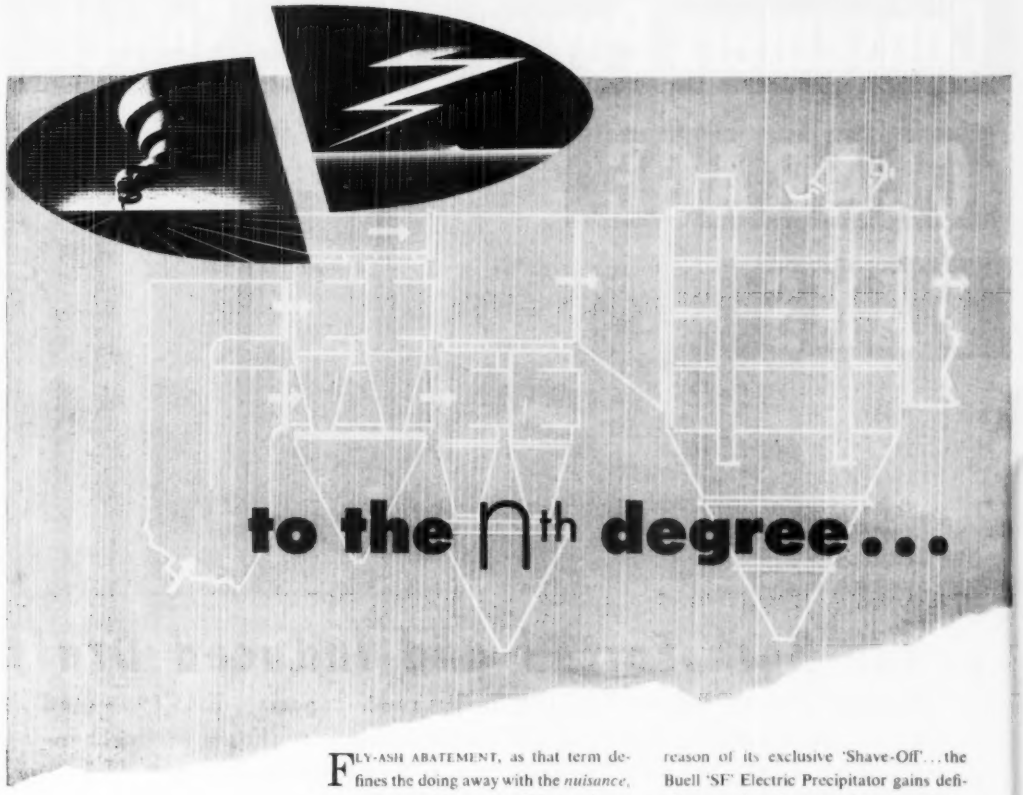
THE Erie City V-C Steam Generator is available in a wide range of capacities for varying space limitations and for all firing methods. Write for bulletin 37.

ERIE CITY

COMPLETE STEAM POWER PLANT EQUIPMENT

Complete Steam Generators • Type C 3-Drum Boilers • Type VL 2-Drum Boilers • The "Economic" Boiler with or without Water Walls • Welded H. R. T. Boilers • Welded Steel Heating Boilers • Coal Pulverizers • Underfeed and Spreader Stokers • Welded Pressure Vessels for the Process Industries.

ERIE CITY IRON WORKS • ERIE, PA. • *Since 1840*



to the n^{th} degree...

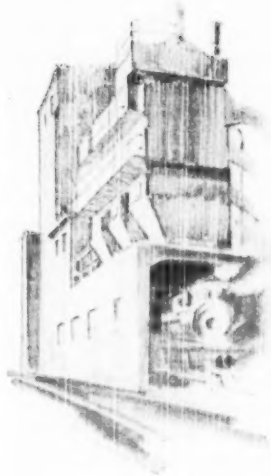
FLY-ASH ABATEMENT, as that term defines the doing away with the *nuisance*, is a call to positive action. What action is most positive, what combination of collectors most trustworthy, stands well proved among engineers—and in the court of public opinion.

Management's purpose to take most positive action is served to the n^{th} degree by a Buell 'SF' Electric Precipitator, in tandem with matching-capacity Buell van Tongeren Cyclones.

To the equipment phase of planning, Buell today offers designs based on world experience in both Precipitator and Cyclone dust collection. The Buell van Tongeren Cyclone excels in practical effectiveness by reason of its exclusive 'Shave-Off'...the Buell 'SF' Electric Precipitator gains definite operating advantage through such design features as StediFlow dust-fall.

To the engineering of such an installation, Buell brings the broadest consulting experience in high-efficiency dust collection—and a notable forth-rightness in predicating operating guarantees on attainable fractional efficiencies.

Buell engineers will welcome the opportunity to confer on basic problems or on the details of equipment. Literature for preliminary study on the collection of nuisance dust on request. Write Buell Engineering Company, 70 Pine Street, Suite 5045, New York 5, N. Y.



buell

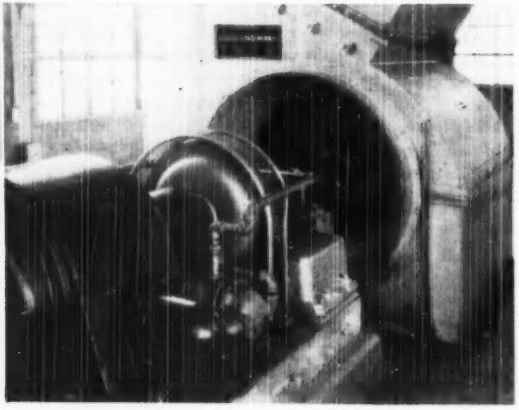
Engineered Efficiency in **Dust Collection**

Consumers Power *Again* Selects

CLARAGE FANS

. . . for Both Forced and Induced Draft

Built in 1940 — enlarged to practically twice capacity in 1949 — and *both times* Clarage HEAVY-DUTY equipment was chosen for mechanical draft in this John C. Weadock plant, Bay City, Michigan.



One of the four Clarage forced draft fans; each 100,000 c.f.m. at 12" S.P. There are also two Clarage induced draft fans included in this latest Weadock power plant installation; each with a capacity of 330,000 c.f.m. at 17" S.P., 350° F.

CLARAGE FAN COMPANY
KALAMAZOO, MICHIGAN

All told, Consumers Power Company has had 24 years of experience with Clarage forced and induced draft fans. Other installations include: East Ave. Station, Kalamazoo (1926); Elm St. Station, Battle Creek (1938); Bryce C. Morrow Station, Comstock, Michigan (1939).

Specialists in this exacting field of mechanical draft, we have facilities to meet all requirements. To date over 3,000 power plants are Clarage equipped. If you are looking for the *best in performance* and *dependability*, it will pay you to consult with us.

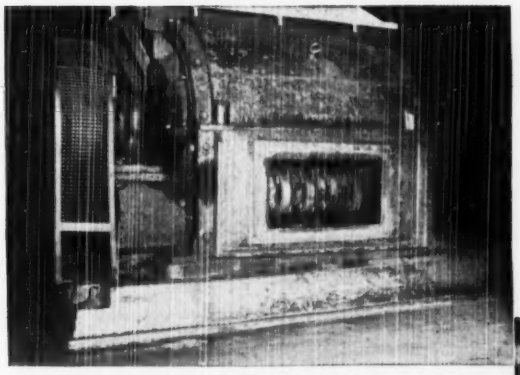
CLARAGE
—HEADQUARTERS for Air Handling and Conditioning Equipment

Sales Engineering Offices in All Principal Cities

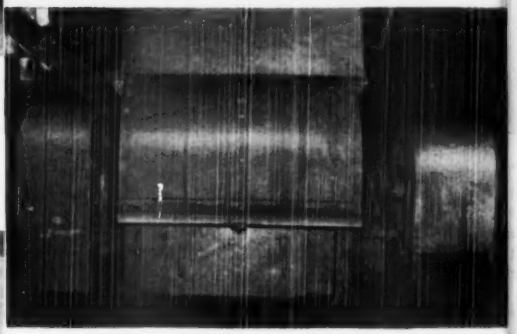
PROVED Champions of Quality...

AMERICAN CRUSHERS handle high tonnage for years with *amazingly* LOW *parts replacement* costs!

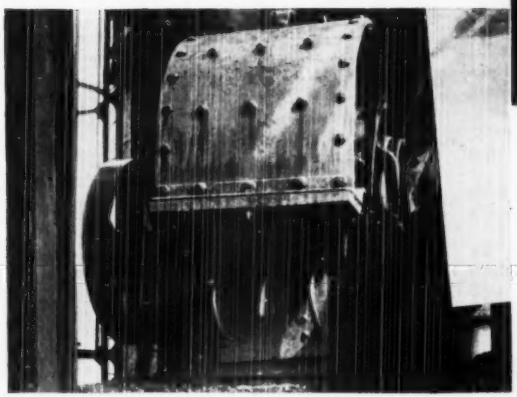
The most convincing proof of American Crusher *quality* can be obtained by comparing *cost of replacement parts needed* to *tons of coal crushed* in specific operations. Taken from an extensive independent survey of users' the following case analyses are typical—



A Power Plant in Illinois ▼
TYPE CRUSHER: AMERICAN 42S
YEARS IN SERVICE: SIX
TONNAGE HANDLED: 2,950,000
PARTS COST PER TON: $.0004



◀ **A Central Station in New Jersey**
TYPE CRUSHER: AMERICAN 42S
YEARS IN SERVICE: TWENTY
TONNAGE HANDLED: 6,000,000
PARTS COST PER TON: $.00025



◀ **An Industrial Power Plant in Ohio**
TYPE CRUSHER: AMERICAN 15C-1
YEARS IN SERVICE: NINETEEN
TONNAGE HANDLED: 182,000
PARTS COST PER TON: $.0000

These typically low parts cost figures are revealing—*they help to explain why American Crushers can reduce coal for less than 1 cent per ton even when all other operating costs are included!*

Write for Literature on AMERICAN CRUSHERS

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

1349 MACKLIND AVE.
ST. LOUIS 10, MO.

AMAZING "Ultrasonic" EYE

Sees Through Metal

at

Pittsburgh Piping
AND EQUIPMENT COMPANY

The illustration above shows P.P.&E. high pressure, high temperature piping being tested by means of a Reflectoscope which produces pulses of vibration waves of a frequency above hearing and transmits them at an angle into the metal through a searching unit which contains a sensitive quartz crystal.

The slightest discontinuity in the metal interrupts transmission of the waves, reflecting them back to the searching unit where the crystal converts mechanical vibrations into electrical energy. This voltage, amplified in the receiver, produces a visual indication of the defect on the screen of a cathode ray tube.

This unique testing method can detect flaws that can be found by no other non-destructive test. Its use assures quality control of materials and welding.

Look to Pittsburgh Piping and Equipment Company for leadership in methods that assure greatest safety, highest efficiency, and longest service from high temperature, high pressure piping.

Pittsburgh Piping
AND EQUIPMENT COMPANY
10 Forty-Third Street—Pittsburgh, Penna.

Woolworth Building, New York
Whitehead Building, Atlanta
Book Tower, Detroit
523 Market Street, San Francisco
Peoples Gas Building, Chicago
Public Square Building, Cleveland
10 High Street, Boston
Heights State Bank Bldg., Houston

How the *"Ultrasonic"* Eye Works

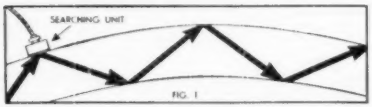


FIG. 1

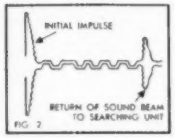


FIG. 2

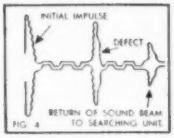


FIG. 4

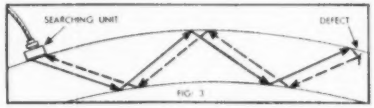


FIG. 3

Intermittent ultrasonic vibrations are transmitted angularly into the section under inspection, so that each sound beam is reflected away from its point of origin progressively from inner to outer pipe wall surface in a consistent pattern, as shown in Fig. 1, until it circles the pipe and returns to the searching unit. The uninterrupted flow and return of the beam is indicated on the oscilloscope screen as diagrammed in Fig. 2. Any discontinuity in the metal lying in the path of the sound beam will interrupt transmission as shown in Fig. 3, reflect the sound back to the searching unit, and provide a visual indication of its presence and location on the oscilloscope screen (see Fig. 4).

...Digging for facts

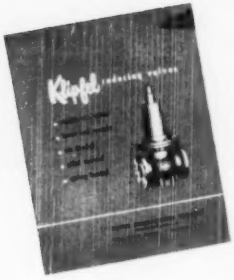
ON AUTOMATIC REGULATING VALVES?

YOU'LL FIND THESE KLIPFEL BULLETINS PRACTICAL, FACTUAL AND USEFUL!

Klipfel engineers have put a lot of experience and research into these bulletins to make them useful to you . . . the man who uses or specifies automatic regulating valves. Each bulletin covers such points as: the advantages and limitations of different valve constructions; selecting the proper type valve for given operating conditions; determining the most effective and economic size valve for the job.

In short, Klipfel engineers have prepared these bulletins to assist you in selecting the type and size valve best suited to your needs.

Write Dept. DC-9 for any bulletins you wish. We'll gladly send them to you.



KLIPFEL REDUCING VALVES
for steam, air and water . . . in lever and weight, air loaded, pilot control and spring loaded types; descriptions, illustrations and complete selection data in Bulletin 148.

KLIPFEL FLOAT VALVES
Single and double seated types with direct action or pilot control for remote location. Types shown include quick-acting valves; all are available in angle and globe patterns. Bulletin 349.

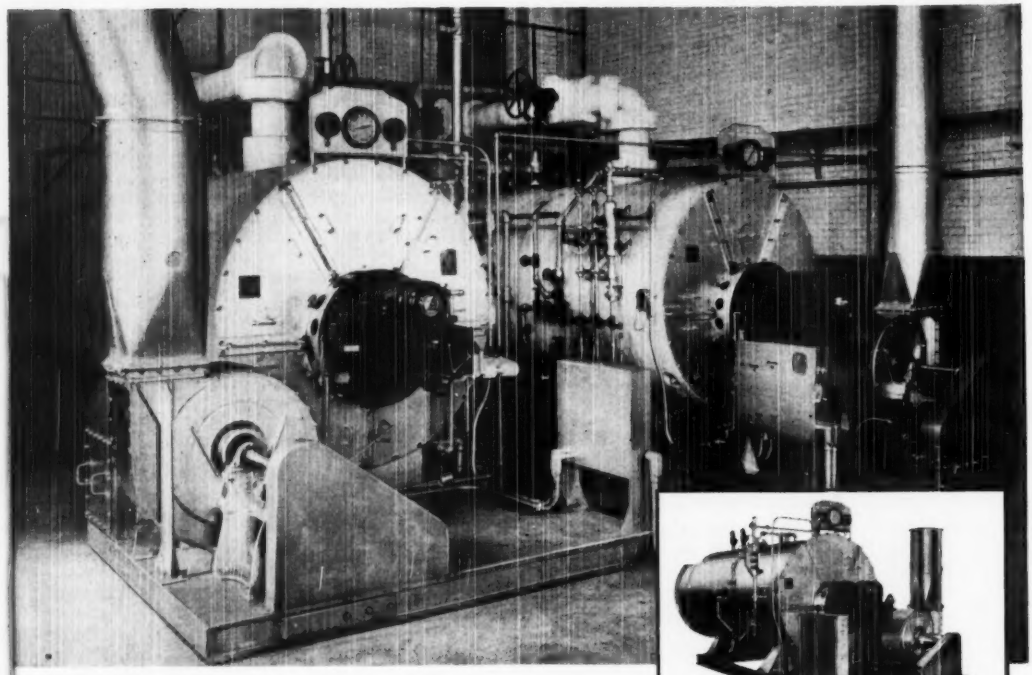
KLIPFEL THERMOSTATIC VALVES
vapor pressure operated valves with spring or weight and lever loading. Valves are ball type, balanced cup and disc or balanced inner valves. Min. temp. 80°. Max. temp. 250°. Range limit of any instrument 40°.

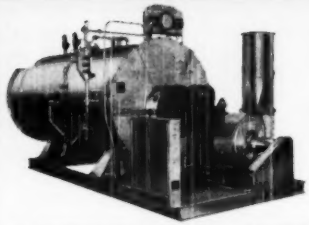
KLIPFEL BACK PRESSURE AND RELIEF VALVES
for control of air, steam and water pressures at the valve inlet in various types for practically any service. Bulletin 648 gives complete details including dimensions and capacities.

Klipfel VALVES INCORPORATED

DIVISION OF HAMILTON - THOMAS CORPORATION, HAMILTON, OHIO

Habitant Soup Co. Cuts Steam Costs 35% *with Preferred Units*





Here's what the Habitant Soup Co. of Manchester, N. H., reports: *"More than two years ago we installed two Preferred Unit Steam Generators and we're frankly amazed at the small amount of fuel they consume to produce more than enough steam for our requirements. In fact, they cut our fuel bills by 35%.*

"Maintenance of the Preferred units is practically nil because they are fully automatic. We're glad to report that both boilers are working like a charm."

There are a host of good reasons for these savings. Fuel costs go down, for example, because Preferred Unit Steam Generators offer fully automatic operation with inexpensive No. 6 oil. But Preferred units assure *even more* than appreciable, immediate returns on your investment. They are designed to give *continuing economical* operation for at least 25 years.

For proof, read the 25-year features in the panel at right. For full details, send for Bulletin 1000.

PREFERRED UTILITIES MFG. CORP.
1860 BROADWAY, NEW YORK 23, N. Y.

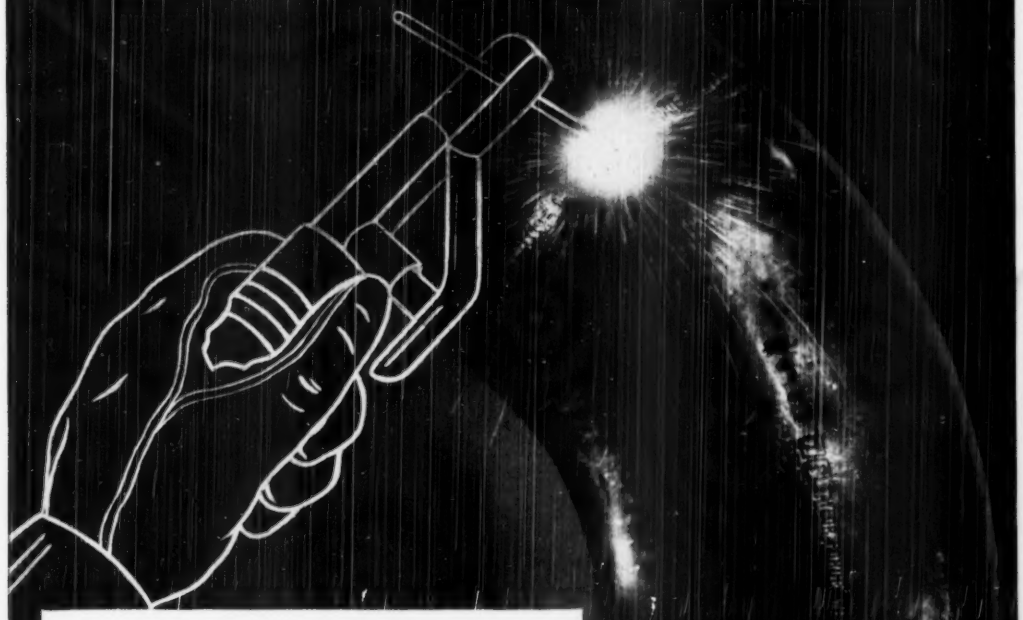
8 PREFERRED 25-YEAR FEATURES

- **4-pass, high velocity, gas travel—minimizes tube cleaning maintenance by self-cleaning action.**
- **Staggered tube construction—minimizes the possibility of tube pitting, even at low firing rates.**
- **Preferred-built 4700 rpm Horizontal Rotary Oil Burner—assures fully automatic operation even with No. 6 oil.**
- **Anti-stress deck for tube sheet protection.**
- **Self-cleaning *induced draft* fan with air cooled shaft and bearings—built to last 30 years.**
- **Down-draft gas travel for 80% thermal efficiency—proved and guaranteed.**
- **Special *precipitator* developed by Preferred as aid to safe and clean operation.**
- **Dual purging cycles for positive elimination of gas stratification.**

PR-191

PREFERRED UTILITIES MFG. CORP.

WeldELLS®



...There are no fittings like WeldELLS

When we say there are no welding fittings like WeldELLS we feel that we are simply repeating the expressed opinions of thousands who know pipe welding.

Often it is the opinion of a designer who recognizes the engineered strength distribution and closely controlled metallurgy of these fittings that are designed by engineers.

Frequently, it is the opinion of a construction superintendent, maintenance man, or welding foreman who has discovered job-speeding, cost cutting features in WeldELLS that are combined in no other fittings.

Sometimes it is the opinion of those whose unusual requirements can only be satisfied in the broader Taylor Forge line; for in certain sizes, weights and materials it can be truthfully said that *there are no fittings* BUT *WeldELLS!*

TAYLOR FORGE & PIPE WORKS
P. O. Box 485, Chicago 90, Illinois
Offices in all principal cities: Eastern Plant: Carnegie, Pa. Western Plant: Fontana, Calif.

Taylor Spiral Pipe is again promptly available in a broader range of sizes and thicknesses. Coupon brings pipe bulletin.

☐ Please send new Catalog 484 covering welding fittings and forged steel flanges.
☐ Send new Bulletin 493 covering Taylor Spiral Pipe and related fittings.

NAME _____
POSITION _____
COMPANY _____
STREET ADDRESS _____
CITY _____ ZONE _____ STATE _____

Mail to Taylor Forge & Pipe Works, P. O. Box 485, Chicago 90, Ill.

501-0950

TAYLOR FORGE

are businessmen

COLD-BLOODED?

OF COURSE NOT! Literally, their normal body temperature is 98.6—same as laborers, engineers or any other group of people. And, figuratively, they're no more, or no less, cold-blooded—as a group.

We all know unreasonable generalizations can be dangerously false. Common sense and on-the-job experience show us the value of dealing specifically with ideas, problems—and *people*.

Let's not make the big—and costly—mistake, then, of generalizing on religious or racial groups. Adopt and *carry out* these common sense principles:

1. Accept—or reject—people on *their individual worth.*
2. Don't listen to or spread rumors against a race or a religion.
3. Speak up, wherever we are, *against* prejudice. Work for understanding.

A PUBLIC SERVICE PROJECT
THE ADVERTISING COUNCIL

Published in the public interest by:

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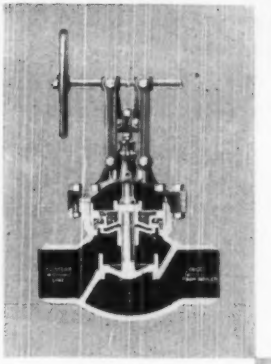
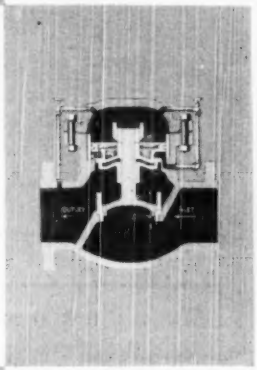
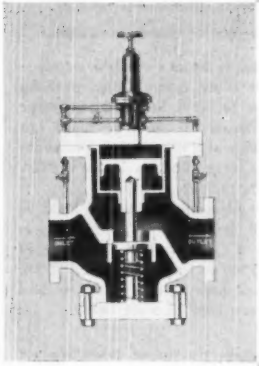


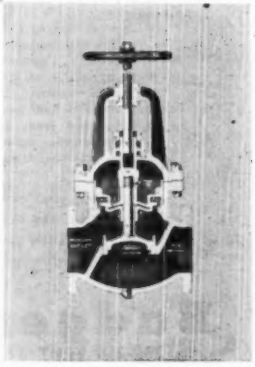
G-A double-cushioned single-acting non-return valve, toggle yoke assembly, globe pattern.



G-A double-cushioned check valve, globe pattern.



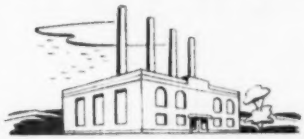
G-A cushioned unloading valve, globe pattern.



G-A combined throttle and automatic engine stop valve, globe pattern.

Your best PROTECTION

against sudden shock, "hammer" and costly damage



GOLDEN-ANDERSON

Automatic

Cushioned *Steam plant*

VALVES

Golden-Anderson Valves have proven efficiency, quality and dependability for over 35 years in the tough applications put to them by America's industrial and power plants. The cushioning arrangement in all G-A valves permits them to operate smoothly at all times.

Golden-Anderson designs and builds over 1500 types and sizes of valves for engineered protection and high pressure installations. Let our experienced engineers help you on your next valve problem.

GOLDEN-ANDERSON *Valve* SPECIALTY COMPANY

2070 Keenan Building · Pittsburgh 22, Pa.

GA

LIFE AND PROPERTY PROTECTION

VALVES

FOR OVER 50 YEARS

CHICAGO

CHICAGO
DEAERATING FEEDWATER
HEATERS

- Stop boiler pitting, recover exhaust and flashed steam, save condensate, reduce make-up, cut fuel costs.
- Are engineered to fit every type of boiler plant operation and hook-up.
- Standard units 3000 to 100,000 lbs./hr.; larger sizes engineered to order.
- *All* internal parts are 18/8 stainless steel—no maintenance from corrosion.
- Agents in principal cities trained to give you engineering help on hook-up.
- Write for instructive bulletin today.

CHICAGO HEATER COMPANY
30 N. LaSalle St., Chicago 2, Illinois

Represented in New York City by The Kissick Co.

Badger expansion joints
help N. Y. Steam Corp. cut maintenance on about 75 miles of steam lines

When a Gothamite wants steam — unlike water — there's no shortage, New York Steam Corp. provides it instantly. From Battery to 92nd Street this gigantic system — the world's largest — at peak loads can serve over 10,000,000 pounds of steam per hour to about 3,000 Manhattan buildings. (See "The Heat's On in New York," Business Week, Jan. 14, '50)

Maintenance costs could easily get out of hand in such a vast underground system. Best protection? — The best equipment. And in Expansion Joints that means Badger. Since the early 1900's New York Steam Corp. has installed thousands of these famous joints — and maintenance costs have been kept to a minimum.

These construction features on Badger Joints can cut your costs too:

- **Directed-flexing rings . . . equalize stresses *between* and *within* corrugations**
- **Packless . . . pressure-tight single tube**
- **Compact . . . no larger than flanged fitting**
- **Special forming . . . no structure-weakening stresses**
- **Controlled heat treating . . . assures long life**
- **Fabricated from copper for normal pressures and temperatures, stainless steel or alloys to withstand high pressure, temperature and corrosion**

How about your expansion joint problems? Are you getting less than the best in performance? . . . In low cost operation? Then there's good news for you in the Badger story — write for details today.

Badger MANUFACTURING COMPANY
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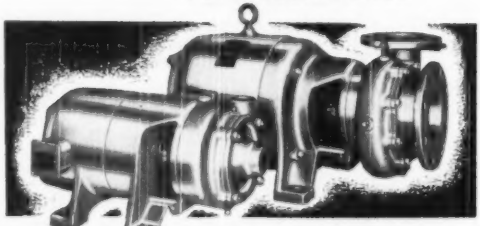
New... Different
THE "ALTA" LINE
FOR INDUSTRIAL USE



CLOSE-COUPLED and PEDESTAL GORMAN-RUPP PUMPS

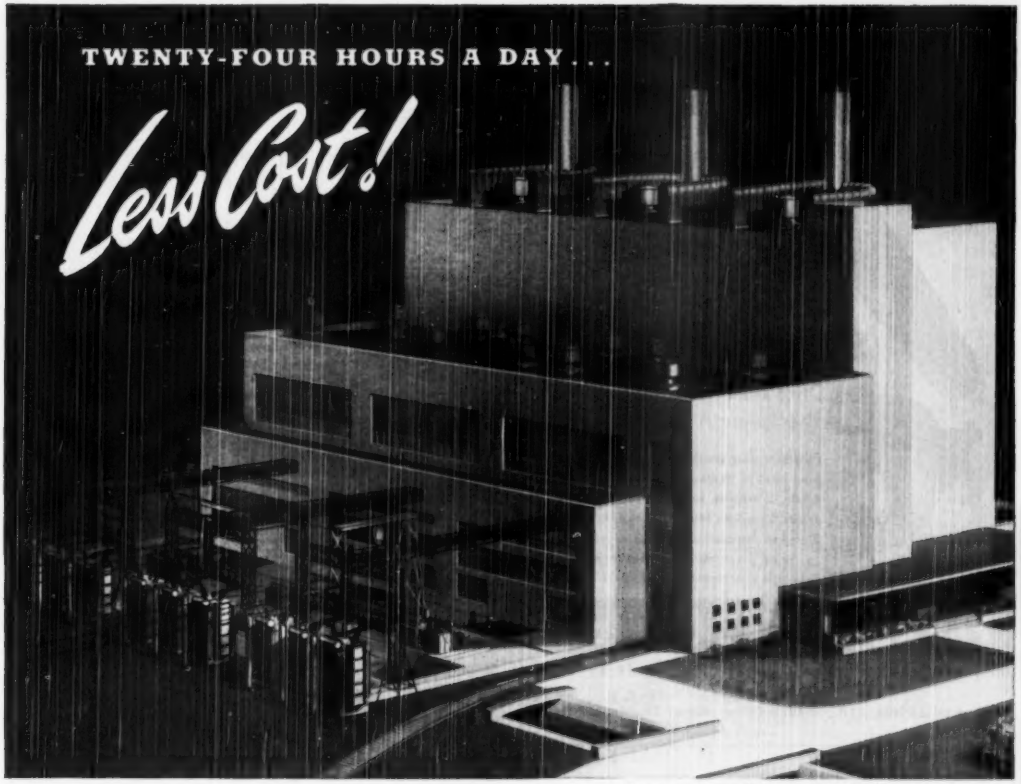
This new line of centrifugal pumps combines all the advantages of exact hydraulic engineering with best mechanical design.

Alta Pumps are outstanding in efficiency serving a capacity-head range up to 1000 G.P.M. and 200 feet head with 14 sizes, 1 to 4 inches.

Open as well as enclosed type impeller for slurry and other services.

For detailed information ask for Bulletin 9-IP-11.

THE GORMAN-RUPP COMPANY
MANSFIELD, OHIO



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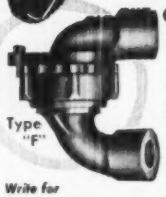

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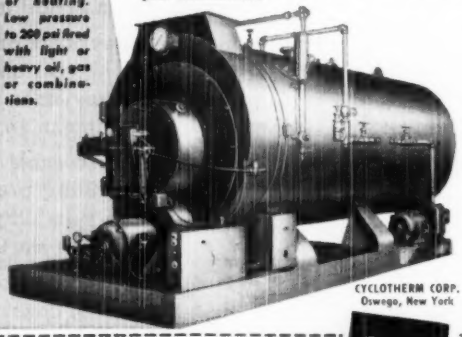

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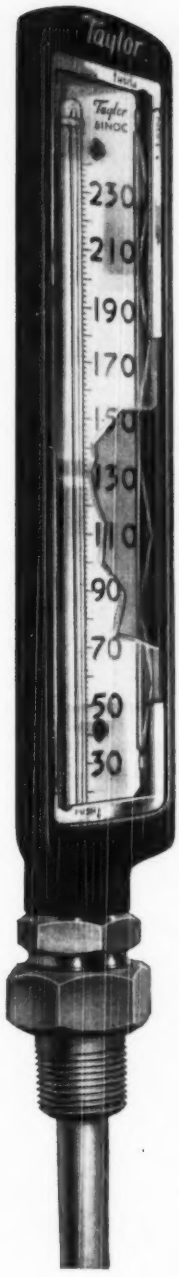

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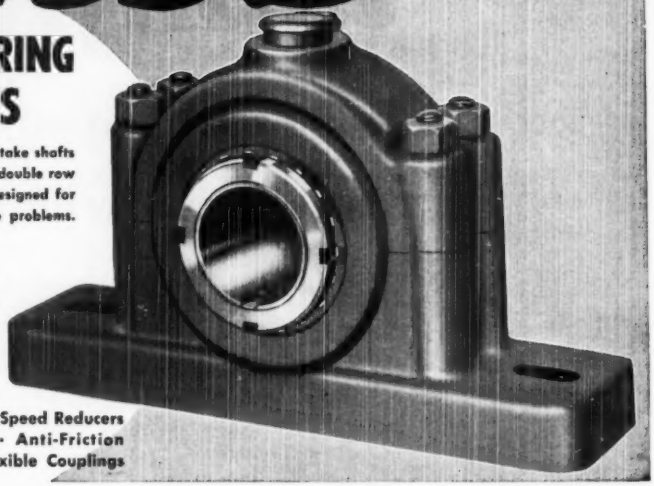

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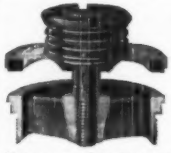

Best money saving investment in a power plant.

Has a one piece bronze metal body with two rubber composition Inserts securely locked into the valve body. Seats screwed or pressed in. For Waterwks. BF. Vac. & Gen. Ser. pumps. Write for complete details.

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SECO METAL SEATS AND DISCS — Durable SECO Metal resists wiredrawing. More than *twenty years of experience* in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

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SPRING OUT OF PATH OF STEAM — The spring in the Spence Regulator is out of the path of the steam or other fluid flowing through the valve. It operates at low unit stress for exceptionally long life.

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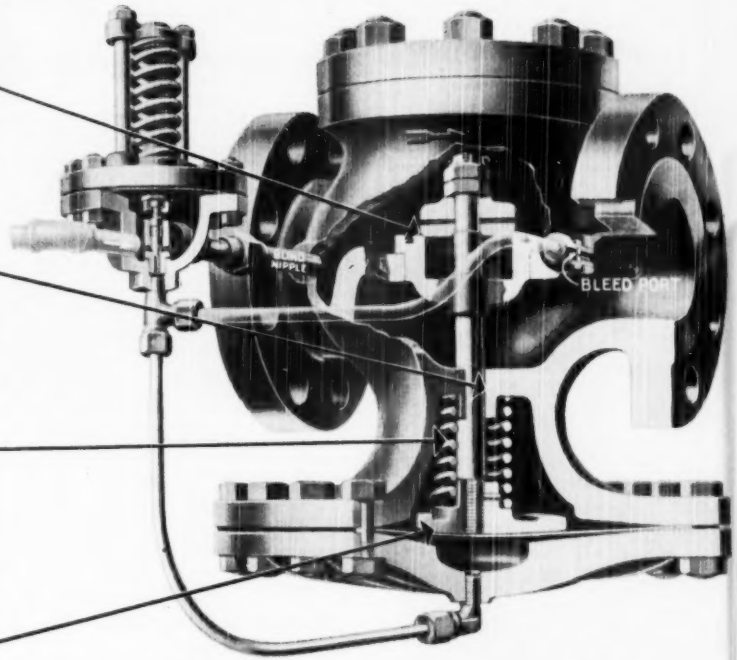

Spence Type EQ back pressure regulator-operation of main valve is controlled by a sensitive pilot to regulate the initial pressure. Same pilot is used with all sizes of main valves.

The features shown above explain why you profit on every important count with Spence Pressure and Temperature Regulators.

Learn more about these and many other advantages of Spence Regulators by sending for Bulletin 350.

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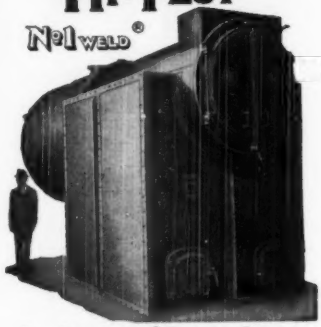

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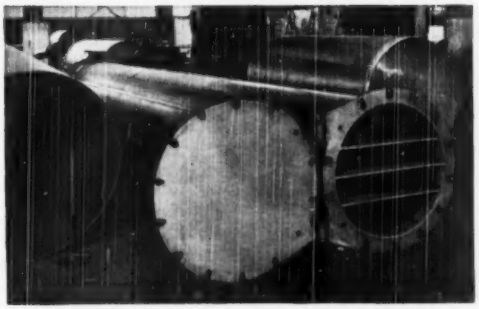
MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company "Bridgeport" *Headquarters for BRASS, BRONZE, and COPPER*

Duplex Tubes Boost Efficiency of Waste Water Heat Reclaimers

Many valuable sources of heat have been overlooked for a long time. Now reclamation and reuse of heat which was normally wasted is spreading quite rapidly to industrial fields as an effective means of cutting costs. This practice, however, has been long used in power, petroleum and chemical processing operations.



Waste water heat reclaimer used at a bleachery is one of four in system designed to reduce fuel consumption and relieve over-loaded boilers—Courtesy Patterson-Kelley Co., East Stroudsburg, Penna.

For example, Duplex Tubing (steel inside and copper outside) is playing an important part in the transfer of heat from waste water to fresh water used in mill bleaching processing.

Four waste-water heat reclaimers are utilized in system illustrated above designed to reduce fuel consumption and relieve over-loaded boilers. They are single-unit, closed-type, multi-pass construction on both tube and shell side.

High velocity waste water containing caustics passes through the tubes and soft fresh water at controlled velocity through the shell side.

RESULTS OF HEAT TRANSFER TESTS
DUPLEX VS. SINGLE WALL TUBING
Steam Condensed on Outside Surface With Fresh Water Passing Through The Tubes

Water Velocity Feet per Second	OVERALL HEAT TRANSFER RATE AT INDICATED WATER VELOCITY BTU./HR./SQ. FT./° F.	
	Duplex Tubing ¾" O.D. x Wall Thicknesses .0325" and .0325"	Regular Tubing ¾" O.D. x Wall Thickness .065"
2½	Steel to Steel 371	Steel 380
3½	458	458
2½	Copper to Copper 580	Copper 600
3½	750	740
2½	Steel to Copper 465	Steel 380
3½	625	458

1610 Gallons Heated Per Minute

The total overall heat recovery of the four units is theoretically set at approximately 4.5 million BTU's per hour. This is equivalent to approximately 47,000 lbs. of steam per hour at 100 lb. pressure which would ordinarily be used for heating the 1610 gallons of fresh water passing through the reclaimers per minute.

Steel-Copper Duplex Selected

Since the analysis of the waste water indicated a high caustic content, steel was selected for the inner section of the Duplex Tube. Copper was used to the fresh water side because the type of water involved would have attacked the steel quite rapidly. At the same time Duplex Tubing (copper-steel) increased the heat transfer characteristics of the units above what would have resulted with single-walled steel tube.

A better heat transfer rate of this Duplex Tubing also resulted in a more efficient unit as compared with a similar unit with single-walled steel tube.

Heat Transfer Tests

To test the heat transfer of the mechanical bond use the Bridgeport's Duplex Tubing, tubes of the same material were drawn together in the same manner as used for duplex. These Duplex-walled tubes were compared with single-walled tubes of the same dimension. The tests showed that the mechanical-bonded tubes gave identically the same heat transfer value as for single-walled tubes (see table).

Workmen making up tube bundle with Duplex Tubing (copper-steel) for waste water heat reclaimer—Courtesy Patterson-Kelley Co., East Stroudsburg, Penna.

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The importance of this new development to Industry offers an exceptional opportunity for large repeat business to Sales Engineers who have Combustion experience in the Industrial and Utility Power Plant fields.

Salary, Expenses and Commissions. Agents also considered.

State experience and qualifications in reply.

SW-6533, POWER
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Wanted—Experienced Construction Engineer for large turbo-generator power plant on East Coast. Must have recent experience in directing operations for complete project, with knowledge of sub-aqueous operations and construction of docks and waterfront facilities. Write giving full particulars of education, experience and salary expected.

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330 W. 42 St., New York 18, N. Y.

Engineers — Executives — Technical Men
Salaried Positions, $4,000 to $30,000

This Confidential service for men who desire a new connection, will develop and conduct preliminary negotiations without risk to present position. Send name and address for details.

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POWER ENGINEER—Twenty-five experience, operation and maintenance of modern power plants, electrical equipment, refrigeration, air conditioning and water filtration plants. Fifteen years high pressure plants, some construction experience, desire supervisory-engineer position with a utility, industrial plant or municipality. Registered engineer, gold seal licensed power plant operator. Will relocate or travel. PW-6662, Power.

MECHANICAL ENGINEER, B.S., 33, single, 9 yrs. experience with leading companies on thermodynamic power cycle analysis; design and stress analysis of rotating machinery and piping; experimental research; seeks industrial or utility design or development work. PW-7145, Power.

DIESEL POWER Plant or pumping plant operator. 10 years' experience including 1½ years chief operator and maintenance supt. of 2400 h.p. generating station in Saudi Arabia. Reply PW-7427, Power, 68 Post Street, San Francisco 4, Calif.

POWER PLANT Operator, age 29 with eight years experience in modern power plant operation and maintenance, also some refrigeration. Technical school graduate. PW-7433, Power.

OPERATION-MAINTENANCE Engineer Steam or Diesel. Small industrial plant or resort hotel preferred. Twenty-five years' experience. Age 48. PW-7447, Power, 68 Post Street, San Francisco 4, Calif.

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RA-7264, POWER
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For further information write:

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POWER HOUSE Supt. or Asst.—Twenty years operation, maintenance and operating training in power plant and chemicals. Experienced on turbines, boilers, pulverizers, switchgear pumps, and high pressure piping. Excellent personnel handling record. Will take full charge operation, construction, and maintenance. Midwest preferred at once. PW-7467, Power.

MECHANICAL ENGINEER, 32, experienced generally in design, estimating, production, maintenance, construction. Material handling, piping, plant layout, methods, dies, tools, specialized machinery. Supervisory background, seeking responsible position. PW-7452, Power.

PLANT ENGINEER—Maintenance Superintendent—11 yrs. experience power field, 7 yrs. machine fitting, design. Holds certificates through First Class Steam and Diesel, including power generation and distribution—Leith Nautical College, Edinburgh, Scotland. A-1 references. 34. PW-7499, Power.

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A WELL established incorporated company desires to represent a manufacturer of high grade power plant equipment in Northern Ohio territory. Address RA-7366, Power.

SALES-ENGINEER, P.E., experienced selling Industrial Oil Burners, Central Station Air-Conditioning, would like to become Agent or Representative. New York, similar or related field. RA-7192, Power.

SALES ENGINEER operating in the California territory desires line for sale to industry. Commission basis. RA-7463, Power.

WANTED

ANYTHING within reason that is wanted in the field served by Power can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read.

(Additional Positions Vacant Advertisements on the opposite page)

POWER PLANT PERSONNEL

An east coast utility now constructing a new high-pressure pulverized fuel generating station, the first two units of which will have a capacity of 132,000 K.W., will accept applications for employment from qualified persons for the following positions. These positions will be available in the fall.

SHIFT SUPERVISORS

To take full charge of shift operation. Must be thoroughly conversant with all phases of modern high-pressure pulverized fuel power plant operation, both electrical and mechanical. Must have previous supervisory experience in power plant operation.

CHIEF OPERATOR

Responsible for the operation of two steam-electric generating units from a fully centralized control room. Will be required to direct other operators in the performance of their duties and operate the plant from the control room. Must have previous experience as an operator of pulverized fuel boilers, hydrogen-cooled turbine generators, high voltage switchboards, condensers, boiler feed pumps and all related auxiliaries.

ASSISTANT CHIEF OPERATOR

Will be required to assist the Chief Operator in directing the operation of, and operating from the centralized control room all equipment such as pulverized fuel boilers, hydrogen-cooled turbine generators, switchboards, condensers, boiler feed pumps and all related auxiliaries.

MAINTENANCE FOREMAN

Must have good background of experience and be able to direct the maintenance of all power plant equipment, such as boilers, turbines, pulverizers, pumps, fans, air compressors, coal handling, machine shop, etc. Must have good mechanical ability and be able to take full charge of maintenance crew under the direction of the master mechanic. This job to be filled immediately.

INSTRUMENT MECHANICS

Previous experience on power plant instrument work essential. Must have a good working knowledge of and be able to service and repair such equipment as automatic combustion controls, flow meters, temperature recorders, gages, pH controllers and boiler meters. Must have a good understanding of electrical circuits as well as mechanical devices.

Job is centrally located near excellent residential community, good working conditions, forty-hour week (paid vacations, insurance, sick pay and retirement plan). All personnel selected for employment will be given complete job training at full pay to familiarize them with this particular installation before assuming their regular duties.

Include complete resume of experience and qualifications in first letter, together with recent photograph. All applications will be treated confidentially.

P-6897, POWER
330 W. 42nd St., New York 18, N. Y.

WANT TO BUY
Surplus VALVES and Flanged Pipe Fittings
PRUDENTIAL PLUMBING PRODUCTS CORP.
261 East 134 St., New York 54, N. Y.

THE AUSTIN COMPANY
Invites Applications from Capable Engineers and Draftsmen

Opportunities are being offered to Engineers and Draftsmen who can design and/or prepare engineering drawings for industrial buildings and their facilities. Assignments are not for specific projects but are in our regular engineering staffs in long-established offices located on the East Coast, Central West, Gulf Coast, and West Coast. Good working conditions. Established vacation and sick leave plans, also paid holidays.

Positions are open to men possessing a sound background of education and experience and qualifying in—

MECHANICAL

Industrial Plant Equipment • Process Piping • Power Plants • Air Conditioning and Ventilation • Heating Systems • Conveying Systems • Plumbing and Sewers • Sprinkler Systems.

ELECTRICAL

Power Wiring A.C. and D.C. • Industrial Illumination • Power Distribution • Controls • Electronic Applications.

Full particulars as to education, experience, and compensation desired should be given in first letter.

NATIONAL HEADQUARTERS
16112 EUCLID AVENUE **CLEVELAND 12, OHIO**

-TRANSFORMERS-

BOUGHT AND SOLD
We carry a large stock of transformers, and invite your inquiries.
PIONEER TRANSFORMER REBUILDERS
We rewind, repair and redesign all makes and sizes.
One Year Guarantee.
THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
SINCE 1912 CINCINNATI 27, OHIO

Air Compressors Wanted

Horizontal Water Cooled—Any size
also 2 Stage portable unit

L. W. BAUER
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WANTED
USED OZALID PRINTER

or equal for reproduction of drawings, approximately two by three feet at the largest.

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No lengths too long or too short
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2668 CLYBOURN AVE., CHICAGO 14, ILLINOIS

FOR SALE

5 Used I-R Vacuum pumps 6 x 12 type 15-360 RPM—Flywheel grooved for V-Belts.

THE PIERCE GLASS CO., Port Allegany, Pa.

WANTED

Wanted, 60 HP High Speed Steam Engine, for 125 lbs. steam. Prefer high speed with fly wheel governor. Give full description.

CRYSTAL ICE WORKS, INC., Bartow, Fla.

FOR SALE

300 KW 220 DC Elliot Turbine Generator in A-1 condition.

WILLIAM L. MARTIN, II, Trustee
Box 476, Bridgeton, New Jersey

WANTED

Centrifugal oil clarifier—preferably No. 65-55—De Laval.

W-7353, POWER
330 W. 42nd St., New York 18, N. Y.

FOR SALE

1—No. 52-S-1 Pacific Low Pressure Steel Boiler for Stoker Firing. S.B.I. rating 12,150 sq. ft. 715 sq. ft. heating surface, six years old, excellent condition. Call or write The Mutual Mfg. & Supply Co., 2933 Spring Grove Ave., Cincinnati 25, Ohio.

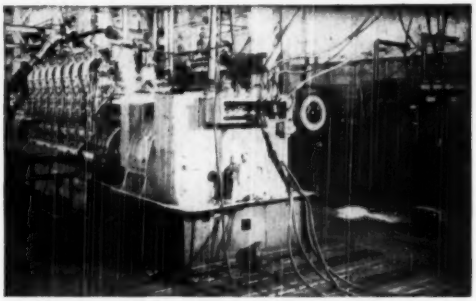
DIESEL POWER

AT 40% TO 60% SAVINGS

EACH ENGINE "REMANUFACTURED"
AND "FULL-LOAD TESTED"
PRIOR TO SHIPMENT

INSPECTION INVITED

ALL EQUIPMENT OFFERED WITH ONE YEAR GUARANTEE



VIEW OF ENGINE TEST STAND FACILITIES AT OUR PLANT IN SAUSALITO (S.F.) CALIF. ALL ENGINE TESTING CONFORMS TO DIESEL MANUFACTURERS' STANDARD METHODS.

A PARTIAL LIST OF OUR INVENTORY

KVA	MAKE	MODEL	HP	RPM	KVA	MAKE	MODEL	HP	RPM
1875	Fairbanks Morse	33E16	2000	300	312.5	Clark	MD-4	375	327
1420	Fairbanks Morse	38D	1600	720	300	Fairbanks Morse	YVA	360	257
1250	General Motors	16-278A	1600	720	250	General Motors	8-268A	350	1200
1000	General Motors	12-278A	1200	720	237	Ingersoll-Rand	S	255	600
937.5	General Motors	12-567	1080	720	200	Buckeye	80	240	600
625	Alco	6-12½x13T	750	600	156	Buckeye	E	190	400
425	Baldwin	VO	510	450	125	General Motors	3-268A	150	1200
400	Buckeye	80	480	600	121	Fairbanks Morse	32E14	140	300
375	Enterprise	DSG-6	450	450	75	General Motors	6-71	90	1200
330	Superior	KNA	396	514	62.5	Int'l Harvester	UD-18	76	1200
312.5	General Motors	8-268A	450	1200	50	General Motors	4-71	60	1200

A. G. SCHOONMAKER COMPANY, INC.

52 CHURCH STREET, NEW YORK 7, N. Y.

SHOPS AND WAREHOUSE: JERSEY CITY, N. J. AND SAUSALITO (S.F.) CALIFORNIA

NORTHERN METAL CO. — MACHINERY at REDUCED PRICES

DIESEL GENERATORS

100 K.W. Allis Chalmers. 1944. 3/60/120/450.
Exciter: 3 K.W. 120 V. D.C.
Diesel Engine: Lorimer. Model F5SS. 150 H.P. 7½"x8½".
5 cylinder, with electric starting motor.

MOTORS

Westinghouse. 1944. Synchronous—Induction.
60 Pole. 3300 S.H.P. 3 Phase. 82.5 Cycles. 2200 Volts.
165 R.P.M. Power Factor 100%.
Exciter: 125 Volts D.C. Load Factor 100%. 1944.

BOILERS

WATER TUBE. Babcock & Wilcox. 1945. 2 Drum. Bent Tube. Economisers. Internal Desuperheater. Superheaters. W.P. 400 P.S.I. Hydrostatic Press. 718 P.S.I. Heating Surfaces: 2441 sq. ft. Superheater 350 sq. ft. Economiser 1620 sq. ft. 3 Todd "Hex Press" Fuel Oil Burners. Diamond Soot Blowers. Auxiliaries available.

NUMEROUS OTHER ITEMS ARE AVAILABLE

MILNOR & BLEIGH STS. • PHILA. 35, PA.

Phone MAyfair 4-1400

TRANSFORMERS — FOR SALE

1 Phase 60 Cycle
Rebuilt and Guaranteed

3—1250 KVA—G.E. 13800 2400
3—1000 KVA—G.E. 13800 480
3—1250 KVA—G.E. 6900 480
3—1000 KVA—G.E. 4800 480
6— 500 KVA—West. 2400 240/480
9— 333 KVA—West. 6900 480
9— 333 KVA—West. 4800 480
9— 333 KVA—West. 2400 480
3— 200 KVA—G.E. 2400 480/240
3— 150 KVA—G.E. 2400 480/240
3— 100 KVA—G.E. 2400 480/240
3— 100 KVA — G.E. 6900/11950Y 460/230
3— 75 KVA—West. 4800/2400 460/230
3— 50 KVA—G.E. 4800/2400 460/230/115
3— 37½ KVA — G.E. 4800/2400 460/230/115

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BUFFALO TRANSFORMER CO.
1510 NIAGARA ST.
BUFFALO 13, N. Y.

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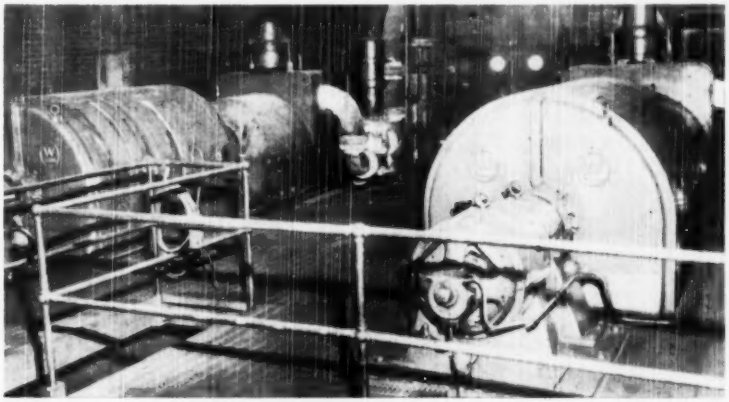
A RARE OPPORTUNITY

5-YEARS SINCE WE COULD OFFER

40/50# Back Pressure Turbines (Non-condensing)

THEY JUST DON'T REACH THE USED MARKET — *Are Always Scarce*



LESS THAN 5% DEPRECIATION ON THE ABOVE 2 TURBINES
Inspection Report Proving This Statement on Your Request

AND—AVAILABLE AT 33-1/3% OF TODAY'S, MFRS. PRICE OR A SAVING OF OVER $70,000.00 ON EACH MACHINE

ALSO IMMEDIATE DELIVERY

SPECIFICATIONS

TURBINE	GENERATOR
Manufacturer—Westinghouse	Manufacturer—Westinghouse
Capacity—2500-KVA.	Capacity—2500-KVA
Steam (Initial)—250/300-psi	Volts—3/60/2300-v.
RPM.—3600-RPM.	Amps.—628
Serial Nos.—18004-5	Serials—283658 : 183658
Water Rate: Full Load—26.0. Direct Connected Exciter	

OTHER NON-CONDENSING TURBINES IN STOCK: 1875, 1563, 937, 625-KVA.,

OUR OTHER SPECIALTIES: CONDENSING TURBO-GENERATORS (Any Capacity) from 300 to 6250-KVA., and Diesel Engines (Any HP.) Boilers

ALWAYS GET WEAVER'S PRICES THEY ARE MONEY-SAVERS

Correspondence Invited

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Wire
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Write

41st FLOOR PENOBSCOT BUILDING
DETROIT 26, MICHIGAN

Telephone Us
Woodward 1340-1
Woodward 6038

POWER EQUIPMENT—READY TO SHIP

A. C. MOTORS—3 PH. 60 CY.

	HP	Make	RPM	Type
1 New	200	West.	1200	Syn.
1 Vert	250	G.E.	1150	(2200 Volts)
1	250	G.E.	1200	(2200 Volts) 1E15A
1	250	Burke	720	(2300 Volts) Syn.
1	200	West.	720	CS-954A
1	200	G.E.	860	(2200 Volts)
1	200	G.E.	1800	(2200 Volts) Syn.
1	175	West.	600	CS-945A
1	175	West.	1200	MS Hi Torque
1	150	West.	257	Syn.
1	150	West.	900	(2300 Volts) Syn.
1	150	West.	500	CS-954A
1	150	West.	900	(2300 Volts) Syn.
1	150	West.	1200	MS Hi Torque
1	150	Louis Allis	1750	FX Spl Pr BB
1	125	Elec. Mach.	164	Syn.
1	125	West.	450	CS-954A
1	125	West.	600	Syn.
6 New	125	West.	1200	Syn.
1	112	West.	1200	Syn.
1	100	Allis Chal.	720	
1	100	West.	900	Syn.
1	100	West.	600	Syn.
1	75	G.E.	514	IK
1	75	Stanley	600	
1	75	Allis Chal.	600	
1	75	Elec. Mach.	900	Syn.
1	75	Louis Allis	1150	Spl Pr BB Hi Torque
1 New	75	Reliance	1200	C-5085F TEFC BB
1 New	75	Reliance	1200	(2200 Volt) TEFC BB
1	75	Master	1750	PA 505 TEFC BB
1	75	Louis Allis	1800	FX 5058 Spri Pr BB
1	60	Allis Chal.	515	
1 New	60	Reliance	880	(2200 or 550 Volts) TEFC-BB
6 New	60	West.	900	CS-TEFC
5 New	60	West.	900	CS-607 TEFC Explosion Proof
1	60	Triumph	1200	B-133
1	60	G.E.	1800	KT-533
1	50	G.E.	425	
1 New	50	Reliance	720	C-5085F TEFC-BB
2	50	G.E	720	KT-546
1	50	Cr. Wh.	900	
1	50	Wagner	900	Fynn Weichsel
1	50	Triumph	880	B-133
1	50	West.	900	CS
1 New	50	Reliance	900	TEFC-BB
1	50	G.E.	1200	KT 336
1	50	G.E.	1200	
1	50	West.	1800	CS
1	50	G.E.	1800	K 405
1	50	Wagner	1800	CP 504
2 New	50	Reliance	1800	AA-5048 TEFC-BB
3 New	50	G.E.	1800	K-504U TEFC-BB (2200 or 550 Volts)
1	50	West.	1800	CS-TEFC-BB

ARC WELDERS

10—200 amp. Hobart with 15 HP., 220/440 v. A.C. Motors portable.

SPECIAL BARGAINS
Diesel Engine Generator Sets

10—100 kw., 120/240 v. D.C. Delco Generators dir. con. to 130 HP Model GBD-8, 5½x7, 8 cyl. Superior DIESEL Engines, elec. start with engine panels

4—100 KW same as above with 220 or 440 v. NEW A.C. Generators

1—63 kva. 120/208 v. 3 ph. 60 cy. 1800 rpm., driven by Cat. DIESEL mt'd on trailer

1—60 kva. Fairbanks Morse 220/440 v. 3 ph. 60 cy. 300 rpm DIESEL

1—75 KW 220/440 v. 3 ph. 60 cy. International GASOLINE

2—75 kva. 220/440 v. 3 ph. 60 cy. Delco Cummins DIESEL

1—62 kva. Fairbanks Morse 220/440 v. 3 ph. 60 cy. 1200 rpm DIESEL

2—37½ kva., 220/440 v. 3 ph. 60 cy. Buda DIESEL

10—NEW 37½ kva., 220/440 v. 3 ph. 60 cy. LeRoi Gasoline

1—31.3 kva. 120/208 v. 3 ph. 60 cy. G.E. Gen. driven by LeRoi GASOLINE

11—NEW 25 kva. 120/229 v. 1 ph. 60 cy. LeRoi GASOLINE

3—25 KW GRAND NEW Onan 220/440 v. 3 ph. 60 cy. 1800 rpm GASOLINE

1—12½ kva. 120/240 v. 1 ph. 60 cy. 1200 rpm., dir. con. Hercules GASOLINE

2—12 kva. 120/240 v. 1 ph. 60 cy. LeRoi GASOLINE

2—7½ kw. 120/208 3 ph. 60 cy. Buda GAS.

230 V. SERIES WOUND MOTORS

HP	Make	Type	RPM
15	G. E.	CO-1807	800
11	Westg.	K-5	470/630
40	Westg.	K-9	700

SLIP RING MOTORS—3 ph. 60 cy.

HP	Make	Rpm	Volts
600	Ideal	1770	220/440
500	Ideal	1770	220/440
400	Ideal	1770	220/440
250	Crocker Wh.	600	220/440
75	G.E.	450	220/440
60	G.E.	570	220/440

A. C. GENERATORS—3 ph. 60 cy.

No.	Kva	Make	Rpm	Volts
6 NEW	100	West.	1200	220/440
10 NEW	37½	West.	900	220/440
3	25	Onan	1800	220/440
11 NEW	25	West. (1 ph.)	900	220/440

GEAR MOTOR BARGAIN

50 HP G. E. 1755 rpm input 13 rpm output speed 220/440 or 550 v. A.C. 3 ph. 60 cy. splash proof ball bearing.

MOTOR GENERATOR SETS—250 V. D.C.
Motors 220/440 volt or 2200 volt

No.	KW	Make	Rpm
3	200	Westinghouse	1200
1	100	Westinghouse	700
1	100	General Electric	900
1	100	Westinghouse	600
1	100	General Electric	1800
1	100	Reliance	580
1	100	Delco	1200

125 V. DC M.G. Sets

1—100 kw. G.E. 125 v. 900 rpm. 220/440 v. 3 ph. 60 cy. AC Syn.

1—75 kw. West. 125 v. 1200 rppm. 220/440 v. 3 ph. 60 cy. Syn.

TRANSFORMERS—1 ph. 60 cy.

No.	Kva	Make	Pri.	Sec.
1	500	Standard	2300	575/460/345
3	500	G.E.	2300	230/460
6	333	Maloney	2300	230/460
3	200	G.E.	2300/4000	230/460
3	150	West.	2400/4160	240/480
3	150	Fgh.	2300	230/460
1	100	Peerless	2300	230/460

ENGINES

NEW 75 HP. P.&H. Model 387C 2 cyl. Diesel
Rebuilt 32 HP. Caterpillar Model D-2400 Diesel
NEW 43 HP. International Model U-6 4 cyl.

NEW AXIAL FLOW VENTILATING FANS

20—6000 cfm Sturtevant Bulletin 512389 3" stat. pres. 7 blade dir. con 5/1.5 HP 1765/1175 rpm 220/440 v. 3 ph. 60 cy. Westg. TEFC Motors.

5—5000 cfm 3.5" stat. pres. Sturtevant with 2 speed 220/440 v. 3 ph. 60 cy. Motors

2—10,000 cfm LADEL dir. con. 2 speed 220/440 v. 3 ph. 60 cy. Motors

1—12000 cfm 3" stat. pres. with 2 speed 220/440 v. 3 phase 60 cy. Motors

2—16000 cfm 3" stat. pres. Buffalo Forge with 2 speed 220/440 v. 3 ph. 60 cy. Motors

1—67000 to 38000 cfm 1" to 9.5" stat. pres. Size 50" dia. 73½" 1, 2 sets propellers International Eng. Co. driven by 100 HP AC Motor

HIGH FREQUENCY M.G. SET

80 kva. 9600 cy. 1 ph. 220/440 v. G.E. dir. con. to G.E 145 HP type K-505 Y 220/440 v 3550 rpm

1000 KW M.G. SET

1000 KW 600 v. D.C. 514 rpm Westg. 2300-3-60 cy. A.C.

PLATING SETS

1—1000 amp. 25 v. G. E. driven by 40 HP 230 v. D.C. 1200 rpm mtr. (Like New).

1—50 KW. Chandeyson 20/40 v. sh. wd. dir. con. 75 HP 220/440 v. 3 ph. 60 cy. syn. motor.

WRITE, WIRE OR PHONE YOUR ELECTRIC NEEDS—SEND FOR STOCK LIST. LIST YOUR IDLE EQUIPMENT WITH US.

Duquesne Electric & Mfg. Co. Pittsburgh 6, Pa.

"IMMEDIATE SHIPMENT"

1—1200 H.P. Moore Automatic Extraction Turbine, 225 PSI, *Turbine Only.*

1—650 H.P. Casey Hedges Box Header Boiler, 225 PSI.

For Complete Description and Quotation

WIRE — WRITE — PHONE

FLETCHER SALES COMPANY

629 FINCASTLE BLDG., LOUISVILLE, KENTUCKY

WABASH 6026

MOTOR GENERATOR SETS

1—500 KW G.E. Syn. 250 V. 900 RPM
1—400 KW WEST. Syn. 600 V. 720 RPM
2—300 KW G.E. Syn. 250 V. 1200 RPM
2—250 KW G.E. Syn. 250 V. 1200 RPM
1—150 KW G.E. Syn. 250 V. 1200 RPM
1—100 KW G.E. Ind. 250 V. 1200 RPM

ROTARY CONVERTER

1—500 KW G.E. Syn. 250 V. HCC 1200 RPM

ARMATURES

1—500 KW G.E. 250 V. MPC Gen. 900 RPM
1—300 KW G.E. 600 V. HCC Conv. 1200 RPM

AIR COMPRESSORS

2—4200' I-R type PRE-2, Size 35x20½x24 Direct Connected to 700 HP G.E. Syn. TS Motor 440/600/2300/4000 V.

WALLACE E. KIRK COMPANY

502 Grant Bldg., Pittsburgh 19, Pa.

FOR SALE
GEARHEAD MOTORS

100—Westinghouse 2 HP, 157 RPM, 3/60/220/440, other sizes up to 15 HP.
Speed Reducers from 3:1 to 1800:1 and up to 30 HP.

SURPLUS & SALVAGE CO., INC.
420 W. 8th St., Jamestown, N. Y.

Boilers of all sizes, W.T. and F.T.
Turbo & Uniflow engine sets
Diesel generating sets, all sizes.
Transformers
Air Compressors, heaters, pumps.
Sugar mill engines

JAMES K. HOOPER, 50 Church St., N. Y.

MODERN AIR COMPRESSORS

6040 FT. INGERSOLL RAND 60 LB. ELECTRIC.
3—3865 FT. NEW CHICAGO PNEU. OCE. ELEC. 125 LB. WITH MOTOR TO SUIT.
3170 FT. SULLIVAN WH4 ELECTRIC. 125 LB.
1578 FT. CHGO. PNEU. DIESEL. 125 LB.
1362 FT. INGERSOLL RAND PRE-2 ELECTRIC. 100 LB.
810 FT. WORTHINGTON V BELT DRIVE. 125 LB. WITH OR WITHOUT MOTOR.
DARIEN, 60 E. 42nd St., New York 17, N.Y.

POWER PLANT MACHINERY

STEAM TURBINE GENERATOR UNITS

3 Phase 60 Cycle

6,250 KVA Allis Chalmers condensing, 200# steam pressure, 500° FTT, 2400/4160 volts, with surface condenser.

5,750 KVA New General Electric condensing, 600# steam pressure, 750° FTT. 2400/4160 volts, with or without new surface condenser.

5,000 KVA New General Electric non-condensing extraction, 600# steam pressure, 750° FTT, 125-150# extraction, 25-50# exhaust, 13,800 volts.

5,000 KVA Westinghouse condensing double extraction, 400# steam pressure, 600° FTT, 125# and 20# extraction, 480 volts, with surface condenser.

4,375 KVA General Electric condensing, 200# steam pressure, 500° FTT, 2300 volts, with surface condenser.

3,750 KVA Allis Chalmers condensing, 250# steam pressure, 550° FTT, 480 volts, with jet condenser.

3,125 KVA New General Electric condensing, 600# steam pressure, 750° FTT, 2400/4160 volts, with or without new surface condenser.

2,500 KVA New General Electric condensing extraction, 400/600# steam pressure, 750° FTT, 100-150# extraction, 480/2400/4160 volts, with or without new surface condenser.

2,250 KVA New General Electric condensing, 400# steam pressure, 725° FTT, 2300 volts, with surface condenser.

1,875 KVA General Electric condensing, 200-400# steam pressure, 700° FTT, 2300 volts, with surface condenser.

1,250 KVA General Electric condensing extraction, 200-400# steam pressure 700° FTT, 0-50# extraction, 2300 volts, with surface condenser.

1,250 KVA Westinghouse condensing extraction, 150-250# steam pressure, 600° FTT, 10# extraction, 480 volts, with surface condenser.

625 KVA Westinghouse non-condensing, 150-200# steam pressure, 600° FTT, 25# exhaust, 480 volts.

625 KVA General Electric non-condensing, 400# steam pressure, 700° FTT, 50# exhaust, 2300 volts.

UNIFLOW ENGINE GENERATOR UNITS

3 Phase 60 Cycle

750 KVA Allis Chalmers-Ames vertical, 150# Steam pressure, 5# exhaust, 2400/4160 volts.

625 KVA General Electric-Skinner horizontal, 150# steam pressure, 5# exhaust, 240 volts.

375 KVA General Electric-Skinner horizontal, 150# steam pressure, 5# exhaust, 240/480/2400/4160 volts.

250 KVA General Electric-Ames vertical, 150# steam pressure, 5# exhaust, 480 volts.

188 KVA Electric Machinery-Ames vertical, 150# steam pressure, 5# exhaust, 480 volts.

STEAM BOILERS

60,000 LBS. Combustion Engineering boiler, 450# steam pressure, 600° FTT, with Coxe traveling grate stoker.

50,000 LBS. Babcock & Wilcox boiler, 300# steam pressure, 530° FTT, with pulverized coal burners.

40,000 LBS. Babcock & Wilcox boiler, 200# steam pressure, 500° FTT, with chain grate stoker.

30,000 LBS. New Combustion Engineering boiler, 450# steam pressure, 550° FTT with spreader type stoker.

DIESEL ENGINE GENERATOR UNITS

3 Phase 60 Cycle

1,250 KVA New Crocker Wheeler-General Motors, 480/2400 volts, 720 RPM.

1,225 KVA Fairbanks-Morse, 2400 volts, 300 RPM.

580 KVA Fairbanks-Morse, 2400 volts, 257 RPM.

250 KVA Electric Machinery-Buckeye, 480 volts, 514 RPM.

187 KVA Electric Machinery-Buckeye, 240 volts, 400 RPM.

75 KVA General Electric-General Motors, 2400 volts, 1200 RPM.

SPECIAL
NEW 2500 KVA TURBINE GENERATOR UNITS
3 Phase 120-240 Cycle

3—2500 KVA General Electric Generators, 3 phase, 120/180/240 cycle, 480/2300/4150 volts, direct connected to General Electric Automatic Extraction Condensing Turbines, 400/600# steam pressure, 100/150# extraction pressure.

Write, Wire or Phone for Further Details and Prices

INTERNATIONAL POWER MACHINERY CO.

UNION COMMERCE BLDG. **Telephone: MAin 1-9514** **CLEVELAND 14, OHIO**

Our 30th Year

HEMPHILL EQUIPMENT PROVES ITS VALUE

Member of The National Industrial Service Association, Inc.

TRANSFORMERS—60 Cycle

Qu.	KVA	MAKE	TYPE	Ph.	VOLTAGES
1	1000	GE	Auto	3/2	4150 x 2406
1	1000	GE	Auto	3	3810Y-2200Y
1	500	Kuhl.	OISC	1	4600 x 2300V
3	400	GE	H	1	6900 x 2250V
1	300	Pitts.	ODSC	1	7800 x 440V
3	300	GE	H	1	2400 x 120/240
1	200	Whse.	Auto	3/2	4150 x 2300
1	200	Pitts.	OISC	1	4000 x 110/220
1	200	GE	Auto	3/2	4150 x 2400
1	150	GE	RS	1	2300 x 230
1	100	Pitts.		1	2750 x 110/220
3	100	Wagner	RCKV	1	240 x 120/120
2	100	Whse.	SK	1	4400 x 220/440 Taps
2	100	Newark	Dry	3/2	440 x 220

MOTOR GENERATOR SETS
3 Phase, 60 Cycle

Qu.	KW	MAKE	SPEED	DC	AC
1	1000	GE	514	600	2300/4150 Syn.
1	500	GE	900	275	2300/4150 Syn.
1	400	GE	900	275	2300/4150 Syn.
1	300	GE	1200	250	2300 Syn.
2	150	GE	1200	125/250	2300 Syn.
1	150	Whse.	600	125	4150 Syn.
1	125	CW	1200	125	2300 SC
1	100	CW	1200	125	220/440 SC
1	100	El.Mach.	1200	125	4150 Syn.
2	75	GE	1200	125	220/440 SC
6	75	GE	1200	60	220/440 SC
1	50	Ridgeway	1200	550	220/440 SC
1	50	Whse.	900	250	220/440 SC
2	40	El.Mach.	1750	125	440 SC
1	35	Ideal	1200	125	220/440 SC

SLIP RING

1	2500	GE	MT	6600	287
1	800	GE	MT	2200	720
1	300	Whse.	CW	440	600
1	250	Whse.	CW	440	600
1	200	Whse.	CW	440	600
1	150	GE	IM	440	450
1	100	GE	IM	440	900
1	75	GE	MT	220	1200 Vert
1	75	GE	MT	440	900
1	60	GE	MT	220	1750
1	60	GE	MT	440	900
1	50	GE	MT	220	1720
1	50	GE	MT	220	1200
1	50	Whse.	CW	220	900
1	50	GE	MT	220	1700
1	50	GE	MT	220	600
1	40	GE	MT	220	1200
1	40	GE	MT	2200	1200

J. L. HEMPHILL & CO.

This Seal is *Your Guarantee*

1604 53rd STREET, NORTH BERGEN, N. J.

PHONE NEW YORK — LONGACRE 5-3227

PHONE NEW JERSEY — UNION 3-2600

MOTORS—M.G. SETS—TRANSFORMERS

SQUIRREL CAGE MOTORS
3-Phase 60-Cycle

Qu.	H.P.	Make	Type	Volts	RPM
1	400	G.E.	I-K	2300	514
1	400	G.E.	KT-412	2200	435
1	250	Whse.	CS	2200	1160
1	200	Al. Ch.	AK	220/440	580
1	150	C.W.	126Q	220/440	870
1	125	Whse.	CS-761C	220/440	1750
1	125	Whse.	CS-772S	2200	1170
2	125	C.W.		220/440	430
1	125	Al. Ch.	AR	220/440	435
1	100	G.E.	1K	220/440	1750
3	100	Whse.	CS-663C	220/440	1750
1	100	Al. Ch.	AR-226	2200	1160
1	100	G.E.	KT-356	2200	865
5	100	F.M.	HS	220/440	880
1	100	Al. Ch.		550	720
1	100	F.M.	H-241B	220/440	450
1	75	Whse.	CS	440	1750
1	75	Al. Ch.	AR	2200	1785
1	75	Burke	EM-10	550	720
3	50	Whse.	CS	220/440	690

SYNCHRONOUS MOTORS
3-Phase 60-Cycle

Qu.	H.P.	Make	P.F.	Volts	R.P.M
1	700	G.E.	80	2300	720
3	450	G.E.	80	440	360
1	400	Whse.	80	440	600
1	300	Whse.	100	440	450
1	268	Al. Ch.	100	2200	900
1	250	G.E.	80	2200	600
1	200	Whse.	80	440	360
1	150	G.E.	100	2200	100
1	150	G.E.	80	550	450
1	150	Whse.	100	2200	400
1	125	G.E.	80	2200	900
3	100	Whse.	90	440	1800
1	100	Whse.	100	2200	1200
1	100	Ideal	80	440	900
2	100	G.E.	80	440	600
1	60	G.E.	80	440	1200
3	50	G.E.	80	2200	600

SLIP RING MOTORS—CONSTANT DUTY
3-Phase 60-Cycle

Qu.	H.P.	Make	Type	Volts	R.P.M.
1**	3000	G. E.	MT	2200	356
1**	2000	G.E.	MT-39	2300	240
1**	1500	Al. Ch.	ANY	2200	230
1**	1200	Cr. Wh.		2200	237
2**	1000	Al. Ch.	ANY	2200	235
1**	800	G. E.	MT-32	4600/2200	300
1**	700	G.E.	MT-432	2200	400
1**	600	G.E.	MT-412	2200	719
1	500	Whse.	C.W.	2300	575
1	500	G.E.	MT-412	2200	450
1	400	G.E.	I-E17-M	2300	875
1	400	G.E.	I-M	2300	590
1**	400	Al. Ch.	ANY	2200	505
1	400	G.E.	MT-412	2200	440
1	300	G.E.	I-E15-M	2200	1200
1	300	Al. Ch.	ANY	2200	505
1	250	Whse.	CW-1106	2200	880
1	250	Whse.	C.W.	550	514
1	200	Al. Ch.	ANY	2200	585
1	200	Whse.	C.W.	440	600
1	150	G.E.	I-E13-M	2200	1750
1	150	G.E.	I-16-M	440	495
1	125	Whse.	C.W.-870	2200	900
1	100	F.M.	H20-C	440	900
1	75	G.E.	I.M.	440	695
1	50	G.E.	MT-536	2200	1150
1	50	Al. Ch.		2200/440	514
1	40	Al. Ch.		2200/440	435

**Mill Type Pedestal Bearing.
NOTE: Some of these motors can be furnished as 2 Bearing.

TRANSFORMERS—(OIL COOLED)

Qu.	K.V.A.	Make	Type	Ph.	Volt.
3	4500	G.E.	HT	3	27000/13500/2300
3	500	G.E.	H	1	13200/11880/220/440
3	200	Pitts.	OISC	1	14400/12600/220/440
3	150	Pitts.	OISC	1	33000/22000/2300/4600
3	130	G.E.	H	1	19000/9500/550/2300
3	100	Whse.	SS	1	12075/10955/230/460
3	100	G.E.	H-KF	1	4160/120/240
3	75	G.E.	H-KF	1	2400/4160Y/120/240
3	50	Al. Ch.	OISC	1	22000/220
2	50	Wagner	HE	1	13200/11880/575/287

MOTOR GENERATOR SETS

Qu.	K.W.	Make	R.P.M.	D.C. Volts	A.C. Volts
2	1500	G.E.	600	600	4160/2400
1	1250	Al. Ch.	720	525	4800/2400
1	1000	Whse.	514	550	4160/2300
1	1000	Whse.	514	275	4160/2300
1	800	Al. Ch.	900	250	2200
1	400	Whse.	900	230	4600/2300
1	300	G.E.	720	250/125	2200/440
2	150	C.W.	900	250	2300/440
1	100	Ridgway	1200	275	4000/2200
1	75	Al. Ch.	900	250	2300
1	75	Whse.	1200	125	440
1	75	Whse.	1200	250	2300/440
3	75	Star	1200	250	440/220
1	50	Reliance	1750	250	440/220
		(4-unit variable voltage set with 5-K.W. exciter)			
1	30	Reliance	1750	250	440/220
2	25	G.E.	1750	125	440/220
2	25	Whse.	1200	120/240	440/220
1	9	G.E.	1750	250	440/220
1	25-KW., 450-V., 3-PH., 60-CY. Dir. Conn. 40-H.P., 230-VDC. 1800 RPM motor.				
(1)—3½-K.W., 440-V., 3-PH., 60-CY., Dir. Conn. 5.5-HP., 230-VDC., 1800-RPM motor.					

DIRECT CURRENT MOTORS

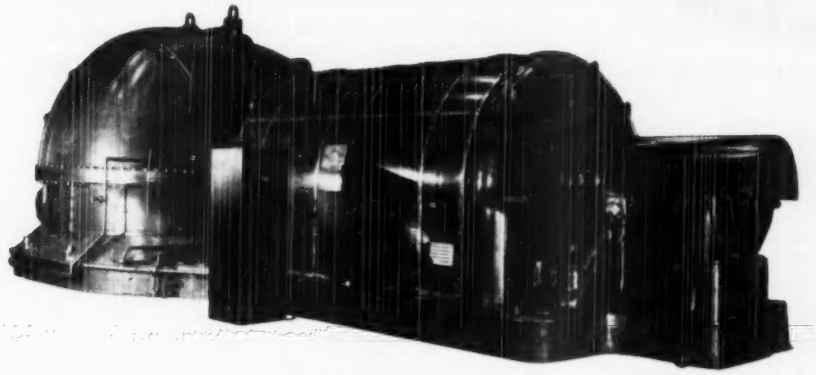
Qu.	H.P.	Make	Type	R.P.M.
1***	2500	G.E.	MCP-14	200/400
4***	1500	Whse.	Encl.	600
2***	1250	Whse.	Mill	300/600
4***	800	Whse.	Encl.	600
1	500	G.E.	MDC	165/330
1	400	Al. Ch.	Mill	400/1200
1	350	G.E.	C.D. 169	1150
1***	350	G.E.	MCP-4	200/600
1	325	Whse.	Q.M.	450/900
1	200/250	El. Dy.	#22	400/1200
1	200	Whse.	Mill	300/1200
1	180	G.E.	MPC	400
2*	150	Cr. Wh.	83-H	800
1	100/125	Reliance	1095-F	300/1200
2	100	Reliance	1058-T	400/1200
1	75	Whse.	1095-F	300/1200
1*	50/75	Reliance	151-L	400/1200
1*	30/75	Whse.	151-L	400/1200
1	50	Whse.	SK	300/1200
1	35	Whse.	SK-140	500/1500
1	22½	Whse.	SK-150	400/1200
1	30	G.E.	CD-105	875/1750
1	25	G.E.	RF-13	400/1600
1	25	G.E.	RF-13	400/1200
1	25	Whse.	SK-NIL	350/1000

Above are all 230-VDC. except where marked ***
****Pedestal Bearing 525/600-VDC. Mill Type—T.E.F.C.

T. B. MAC CABE COMPANY

4314 CLARISSA STREET — PHILADELPHIA, PENNA.

GENERATE YOUR OWN POWER
with "UTILITIES APPROVED" EQUIPMENT



25,000 KVA M—20,000 KW, 80% P.F., 3 phase 60 cycle, 13,200 volts, 1800 RPM General Electric Company condensing turbine generator unit 200-215 P.S.I.G., 540° total temperature complete with direct connected shaft exciter, switchboard and instruments, a 30,000 sq. ft. 2-pass Westinghouse surface condenser, motor driven and turbine driven pumps and condensing accessories.

EXCELLENT CONDITION — COMPLETE INSTALLATION — PROMPT DELIVERY

TURBINE-GENERATOR UNITS

3 phase, 60 cycle

6250 KVA G.E. condens., 3-stage, 2300/4000 volts, 200# P.S.I., 600°TT.

3125 KVA G.E. condens., 130-150# P.S.I., 550 volts.

2500 KVA G.E. Type ATB, Form HT, 2300/480 volts, 3600 RPM, two bearing alternating current generator, LESS TURBINE.

1563 KVA G.E. non-condens., 250 P.S.I., 25# gauge back, 2400 volts.

1563 KVA G.E. condens., 250 P.S.I., 2300 volts.

937½ KVA Allis condensing 250 P.S.I., 700° total temperature, 480/600/2400 volts.

625 KVA G.E. non-condensing 150 P.S.I., 20# back, 480 volt.

375 KVA (4) G.E. condensing 400# pressure, 480/600/2300/4150 volts.

125 KVA G.E. non-condensing, 150-200 P.S.I., 2300 volts.

100 KVA Westghse. non-condensing 125-150# P.S.I. 10# gauge back, 2400 volts.

Direct Current

200 KW (2) G.E., 120 volts, 2 wire condensing 200—275# P.S.I.

150 KW (2) Westinghouse-Worthington, 250 volts, 3-wire, 225-250 P.S.I. condens.

100 KW Allis-Chalmers-Terry, 125 volts, 2400 RPM 150# P.S.I. non-condensing.

75 KW (2) Westinghouse-Moore, 120 volt, 200# P.S.I. condensing.

60 KW (3) new Westinghouse, 120 volt, 200# P.S.I. condensing.

SYNCHRONOUS MOTORS

3 phase, 60 cycle

5000 KVA Westinghouse, 4000 volt, 720 RPM Electrical Synchronous (condenser).

900 HP Allis, 2200 volts, 150 RPM.

300 HP G.E., 80% P.F., 2300 volts, 720 RPM.

MOTOR GENERATOR SETS

300 KW Allis, 250 volts DC generator direct connected 430 HP Allis, 3 phase, 60 cycle, 440 volt, 1200 RPM synchronous motor.

SEPTEMBER BARGAINS

1—8400, 1—4400 sq. ft. surface condensers.

4—900 KW, 250/375 volt direct current generators connected 1200 HP, 8 cylinders, 720 RPM Fairbanks Diesel Engines.

1—5425 GPM, 70 foot head Centrifugal pump connected 125 HP 60 cycle, 2200 volt, 1750 RPM G.E. motor.

2—1000 GPM, 1270 foot head, 4-stage Morris pumps each direct connected to a 417 HP, 390# P.S.I. non-condensing G.E. turbine.

1—G.E. Bank of Scott connected 2 to 3 phase, 60 cycle transformers, 2500 KVA capacity.

150 KW G.E., 125 volt direct current generator direct connected 225 HP, 3 phase, 60 cycle, 220 volt, 1200 RPM synchronous motor.

62½ KVA G.E., 60 cycle, 2300 volt alternator to 75 HP, 125 volt DC motor.

UNAFLOW GENERATOR UNITS

Direct Current

400 KW G.E., 240 volts, 380 RPM generator connected Skinner vertical engine 150#, 10# gauge back.

275 KW Westinghouse, 250 volt generator connected Ames vertical engine.

250 KW (2) G.E., 3-wire, 250 volts generators connected Skinner engines.

Alternating Current—3 phase, 60 cycle

750 KVA G.E., 2300/575 volt generator connected Skinner Vertical non-condensing engine, 150-175# P.S.I.

625 KVA Westghse. 240 volts generator connected Skinner Engine, 120-150 P.S.I.

500 KVA G.E., 2400/480/240 volts generator connected Ames Vertical Engine.

375 KVA G.E., 2300/440 volts generator connected 23"x24" Skinner Horizontal Engine, 120-150 P.S.I.

175 KVA Westghse., 240 volt generator connected Skinner Horizontal Engine, 125-150# P.S.I., 5# gauge back.

UMC UTILITIES MACHINERY CORP.

1965 EAST 6th STREET • CLEVELAND 14, OHIO • Long Distance 422

NO YOU CAN'T BEAT GLOW FOR RELIABLE ELECTRICAL EQUIPMENT

SQUIRREL CAGE MOTORS

HP	RPM	Volts	Make
750	900	6600	Westgh
400	1200	440	G.E.
300	900	440	GE-I-17
350	1200	440	GE-KTR
250	600	2300	Triumph
225	514	440	GE-I-14
200	600	440	Westgh-CS
150	1800	440	Howell-SC
150	600	2300	GE
125	3600	220/440	ALCh.AN
125	1800	220/440	ALCh.AR
125	240	220	ALCh.

SLIP RING MOTORS

HP	RPM	Volts	Make
500	900	440	GE-3 Brg
400	1200	2300	ALCh.
375	1800	2300	ALCh.
350	514	440	G.E.
300	720	2300	ALCh.
250*	600	440	G.E.
250	300	2300	ALCh.
200	1800	440	ALCh.
150	1750	440	GE-MT
150	900	2300	ALCh.
100	1200	550	Westgh-CW
100	400	440	W-E-118

*new motor

MOTOR GENERATOR SETS

KW	DC Volts	HP	AC Volts	Make
1800	250	2500	4000	GE
750	240	1100	2300	GE
400	250	600	220/440	GE
300	250	443	440	GE-EM
200	250	300	440	GE
150	250	235	440	C-W-EM
100	275	150	440	Wtg.
75	125	115	440	GE
50	125	100	2300	ALCh.
33	125	50	440	GE
25	230	40	220	Reliance-GE
20	250	38	220	GE

SYNCHRONOUS MOTORS

HP	RPM	Volts	Make
2000	720	4800	Wtg.
1015	500	2300	Wtg-25 cycle
500	514	440	GE
435	720	2300	GE type ATI
320	900	2300	GE-ATI
250	1800	2300/4160	GE-ATI
250	225	2300	GE-TS
225	900	4160	GE-ATI
220	600	2300	GE-ATI
175	225	230	GE-TS (rotor & stator only
160	600	440	GE-ATI
160	184	480	GB-THF (rotor & stator only
150	1800	2200	GE
150	1800	220	GE-ATI, single bearing
150	900	440	Star
150	720	440	Westgh

FREQUENCY CHANGERS

Output KW	Output Volts	Input Volts	Make
2000	2300	2300	GH
1100	250	Any	GE-HCC
100	2300	375	Wtg.
25	220	115	GE
20*	220	220	Delco
15*	220	220	GE
10**	220	550/320	GE

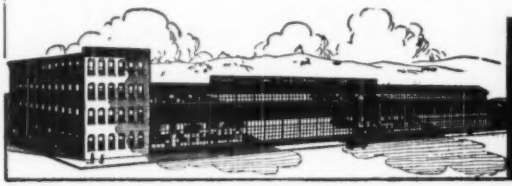
*60/180 cycles—**60/240 cycles

CAPACITORS

KVA	Volts	Phase	Make
75	440	1	Cornell-Dubilier
60	460	3	Westinghouse
15	460	3	General Electric
15	2400	1	General Electric

GLOW ELECTRIC CO., for over 44 years, has done engineered rebuilding of electrical equipment to assure you of quality and dependability.

We invite your inquiries.



GLOW ELECTRIC CO.
927 HARRIET ST. CINCINNATI 3, OHIO
PHONE MAIN 3024

MOTORS • GENERATORS • TRANSFORMERS

200 KW M.G. SET

200 KW Westinghouse NEMA Frame Generator 250 V. DC 1200 RPM direct Connected to 300 HP. Westinghouse Synchronous Motor 3/60 220/440 Volts 1200 RPM. AC & DC Panels—Like new. Ship now.

MOTORS

60—50—25 CYCLE
In stock—all sizes
Slipring — Squirrel Cage — Synchronous
All types of control equipment.

350 KW GENERATORS

2—350 KW General Electric Generators Type MPC, 250 Volt DC, 720 RPM Single Bearing Machines.

DIRECT CURRENT EQUIPMENT

125-250 Volt Motors, Generators and M-G Sets with controls.

SLIPRING MOTORS

500 HP Allis Chalmers type ANY-WR 3 phase, 60 cycle, 2300 volt 514 RPM.
100 HP Westinghouse type CW 3 phase, 60 cycle, 220/440 volt 450 RPM.

FREQUENCY CHANGERS

All Sizes in Stock. 60 cycle to 90 cycle, 100 cycle, 120 cycle, 180 cycle and any other high cycle.

ALL ITEMS IN STOCK FOR IMMEDIATE SHIPMENT

NIAGARA TRANSFORMERS

1 Phase — 60 Cycle — New

Stock Shipment on sizes listed. Short delivery on sizes up to 5000 KVA—1 or 3 phase, in voltage ratings to 69 KV. Standard taps. Built to A.I.E.E. —N.E.M.A.—A.S.A. Standards.

LISTING OF TRANSFORMERS

Quantity	KVA	Primary	Secondary
3	15	7200/12470Y	240/480
3	15	2400/4160Y	240/480
3	25	2400/4160Y	120/240
6	25	2400/4160Y	240/480
3	25	7200/12470Y	240/480
3	37½	2400/4160Y	120/240
6	37½	2400/4160Y	240/480
9	50	2400/4160Y	240/480
5	50	2400/4160Y	120/240
4	75	2400/4160Y	120/240
6	75	2400/4160Y	240/480
3	100	2400/4160Y	120/240
12	100	2400/4160Y	240/480
3	167	2400/4160Y	240/480
3	167	2400/4160Y	120/240
6	250	2400/4160Y	240/480
3	333	2400 x 4800	240 x 480
3	500	7200/12470Y	240 x 480

ERIE ELECTRIC CO., INC.
124 CHURCH ST. BUFFALO, N. Y.
CL. 4758

Reliably Rebuilt Electrical Equipment

41st YEAR

SPECIALS

2—500 KW WESTINGHOUSE Synchronous Rotary Converters, 250 Volt DC, 1200 RPM.

Late Type—Modern—Excellent Condition—Complete

Rebuilt — 1 YEAR GUARANTEE

PARTIAL LISTINGS ONLY

MOTORS
Squirrel Cage 3 Phase

H.P.	Make	Type	Speed
450	G.E. (vert.)	KF-6338	1180
200	G.E.	KT557	1750
200	Wagner	RF2	1750
200	G.E.	KF-6335	880
150	West.	CS	580
125	Al. Ch. (2)	AR	435
100	Wagner New	XP	1150
100	G.E.	K-544	1175
100	West.	CS	870
100	Al. Ch.		580
75	West.	CS	1750
75	G.E. (3)	K-505	1175
75	G.E.	IK	900
75	G.E. (3)	KT-352	865
75	West.	CS	720
75	G.E.	K-356	690
75	G.E.	KT-558	580
60	F-M	Tot. Enc.	1800
60	West. (2)	CS-607	880
60	Rel. (2)	AA	875
60	G.E.	KT-346	865
50	G.E.	FTR-523	3600
50	Elliott	196	3450
50	West.	CS	1740
50	L.A. (3)	XP	1150
50	West.	XP	1150
50	G.E.	KF-445	1170
50	West.	CS-642C	1160
50	West. (3)	CS	870
50	G.E. (2)	IK	870
50	G.E.	FTR-542	870
50	West.	CS	690

MOTORS
Slip Ring 3 Phase

H.P.	Make	Type	Speed
600	Cr. Wh.	131AQ	507
500	G.E. (2)	IM	450
400	West.	CW	514
225	Wagner	25 cy.	710
200	G.E.	MT559	1150
200	G.E. (2)	IM	1170
150	Wagner	31VRN	900
100	G.E.	MT-553	1165
100	Al. Ch.		690
65	West.	CW	1150
65	G.E.		690
50	West.	HF	850
50	Al. Ch.		690
50	G.E.	MT-536	1150
50	West.	CW	1150
50	G.E.	MT-336	1150
50	L.A.	OGH	870
50	F-M	BV	600
50	Al. Ch.	ARY	575
50	G.E.	IM	490

MOTORS
Synchronous

H.P.	Make	Type	Speed
475	West.		720
400	G.E. (2)	TS-928S	600
300	G.E.	ATI	900
260	G.E.	TS	900
200	Ideal	SMW	257
200	G.E. (2)	TS	1200
150	G.E. (2)	TS	1200
180	G.E.	ATI	900
160	G.E.	TS	1200
145	G.E.	ATI	720
135	West.	G	1200
135	Ideal		1200
100	G.E.	TS	1200
55	El. Mchy.	BRKT	1200

MOTORS
550V. D.C.

H.P.	Make	Type	Speed
765	G.E. (6)	MPC	1045/1350

MOTORS
230V. D.C.

H.P.	Make	Type	Speed
400	A-C		415
135	C-W	CCM152H	233/900
125	G.E.	RC-15	1750
100	Al. Ch.		1150
90/45	G.E.	RF-17	950/475
75	Sprague		1000/1600
75	West. (2)	SK-180	475
75	Cr. Wh.	LT	480/670
75	Cr. Wh.	CMC	375/950
75	West. (3)	SK151	250/1000
60	West. (3)	SK-160	680
50	G.E.	RC-12	1750
50	Diehl		850/1050
45/90	G.E.	RC-17	475/1950
50	West. (3)	SK-160	565
50	G.E.	RF-17	250/1000
50	West.	SK	250/1000
40	West.	SK-103	1750
40	Century	DN-454	1740
40	G.E.	RC-31	1700
40	G.E.	RC-32	1100
40	G.E.	RC-34	750
40	G.E. (2)	CD-1441	400/1500
40	Cr. Wh.	CCM	700
40	Rel.	461T	400/1200
35	West.	SK-120	1150
35	G.E.	RLC	440/800
30	G.E. (8)	CDM-85	2200
30	West.	SK	975
30	Cont.	D-103	850
30	G.E.	RC-33	775
30	West.	SA	500/1500
30	West. (2)	SK-143	875
25	G.E.	RC-15	1750
25	West.	SK-83	1750
25	G.E.	CDM-77	1750
25	E.D.	108	1500
25	Rel.	92T	1150
25	West.	SA	500/1500
25	West. (2)	SK-130	600
25	G.E.	RF-14	300/1200

MOTORS
115V. D.C.

H.P.	Make	Type	Speed
300	West.	SK	900
100	Cr. Wh.	CMC	900
40	G.E.	CD-113	850
30	West.	S	600
25	G.E. (2)	CD	1800
25	West.	SK-103	1150
25	Cr. Wh.	CCM	750
25	West.	SA	600/1200
15	E.D.	7½S	650/1230
15	Cr. Wh.	CM	650
12½	G.E. (3)	CDM-85	930/1160
12½	G.E.	*CDM-95	930/1160
10	Century	DN-334	1750
10	G.E. (2)	RC	1200
10	Al. Ch.		900
10	E.D.	7½S	425/1700
10	Diehl		230

GENERATORS—A.C.
Driven by D.C. Motors

KVA	Make	D.C. Input	A.C. Output
288	West.	115	450
75	G.E.	230	240
50	Star	115	120
35	G.E.	230	220
31	Ideal	115	440
31	El. Mchy.	230	440
18	G.E.	230	120/240
10	Burke	115	120
7½	Hertner	115	440
5	El. Spec.	115	110
1½	Al. Ch.	230	110

GENERATORS—A.C.

KW	Make	Type	Speed
216	West.	G	900
180	G.E.	ATB	900
100	G.E.	ATB	360
75	G.E. (2)	ATB	1200
50	F-M	GG	1200
15	G.E.	ASI	1200

Frequency Changers and Generators

Size	Make	Output Frequency
150 KW	G.E.	150 cy.
154 KVA	G.E.	150 cy.
50 KW	G.E.	120 cy.
40 KW	G.E.	100 cy.
30 KW	G.E.	90 cy.
15 KW	G.E.	408 cy.
10 KW	G.E.	200/700 cy.
7½ KW	G.E.	408 cy.
3 KW	G.E.	408 cy.

GENERATORS
600V. M D.C.

KW	Make	Speed
400	G.E. (4)	1200
150	G.E.-RC (2)	1150
100	West.-SK	900
75	West.-SK	1150
60	G.E.	1200
30	Burke	1750
25	Reliance	1150

GENERATORS
250V. D.C. Motor Driven

KW	Make	Speed
1000	G.E.	900
500	West. (2) Rotary	1200
300	Elliott	1200
300	G.E. (3)	720
200	G.E.	1200
150	West.	900
100	Deleo	1200
75	G.E.	1200
50	G.E.	1200
40	Rel. (4)	1750
42	ABC (2)	1200
30	G.E.	1200
25	G.E.	1200

GENERATORS
125V. D.C. Motor Driven

KW	Make	Speed
250	G.E.	720
150	Cr. Wh.	1200
150	West.	1150
100	West. (2)	900
100	G.E.	1200
100	El. Mchy.	1200
75	Cr. Wh.	1200
75	Hertner	1150
50	West.	1150
50	Cr. Wh.	1150
50	Sturt.	2300
35	Ideal	1200
30	G.E.	1150
30	L.A.	1450
25	El. Mchy. (2)	1150

GENERATORS
Low Voltage D.C.

Amp.	Make	Voltage
5000	Optimus	6/12
1500	H-V-W	6/12
125	Hobart (8)	7½
1000	G.E.	15
750	Master	20
1500	Century	24
3000	El. Prod.	24
550	Col.	27
100	G.E.	30
1000	G.E.	33
150	Watton	40
1000	Chandy (3)	40
200	G.E.	42
1500	G.E.	50
1500	Century	60
1500	G.E.	60
1000	G.E.	75

TRANSFORMERS

3—500 KVA Pittsburgh 13200/480.
1—500 KVA, Al. Ch. 3 ph, 41600V. Primary, 230V. Secondary.
1—300 KVA, Pittsburgh, 3 ph, 41600V. Primary, 230V. Secondary.
8—100 KVA West. 3 ph. 440-220 Dry.
2—50 KVA G.E.—11—KF, 2400/4160Y—120/240V. Sec.
4—25 KVA West. 440V. Primary, 110/220V. Sec.
3—15 KVA West. 440V. Primary, 110/220V. Sec.
60—Additional Oil and Insulated Dry-type Transformers in Stock, not listed, down to 1 KVA.

STARTERS—A.C.

1—450 H.P. West. magnetic reduced voltage (550 V.) Synch.
2—400 H.P. C-H Bulletin No. 9976, 440V. magnetic reduced voltage Synch.
1—250 H.P. C-H Bulletin No. 9589, 4150V.
1—200 H.P. G.E. CR-7065, 440V. Synch.
1—150 H.P. G.E. CR-7061, 220V. Synch.
2—100 H.P. C-H full voltage Synch.
40—C-H and A-B, 2 and 4 speed magnetic starters.
635—7½ H.P. C-H 440V. magnetic starters.

STARTERS—D.C.

1—600 H.P. 230V. West. magnetic.
150—New 230V. D.C. magnetic starters, from ½ H.P. to 75 H.P., C-H, G.E., etc.
100—New 230V. D.C. manual starters from 1 H.P. to 5 H.P.—G.E. and C-H.
40—New 7½ H.P. 230V. magnetic reversing.
1—300 H.P. West. 230V. magnetic.
Over 250 additional D.C. starters in stock, not listed, all sizes and voltages.

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GET A-1 PERFORMANCE—SAVE 40 TO 70% IN PRICE

SQUIRREL CAGE MOTORS

3 phase, 60 cycle—220 or 440 volt (*2200 volt or higher)

H.P.	Make	Type	Speed
750	G.E.	KT	720
500	G.E.	KTP-567	1200
400	*Al. Ch.	ANW	900
300	G.E.	FT-559A	1800
250	Westg.	CS-956A	600
200	Reliance	AA-C60858	1200
200	*G.E.	IE-15-K	1200
150	Westg.	CS-771	1800
150	G.E.	IE-13AK	1800
150	G.E.	IE-13B	1200
150	G.E.	I-15-S	900
150	Westg.	CS-950A	600
125	G.E. TEFC	K-6326S	1200
100	U.S.-Vert.	CFU-994-A	1200
100	Burke	EM-12-S	1200
100	G.E.	K-6333	720
75	Westg. New	CS-505-S	1800
75	Westg.	CS-781	1200
75	G.E.	FTR-543-B	1200
75	G.E.	KT-347	1200
75	G.E.	K-505	1200
75	*G.E. Vert.	CS	900
75	*G.E.	I-10-K	720
75	G.E.	FT-558	720
75	Al. Ch.	AN	720
75	*Triumph	TR-16	514
60	G.E. NEW	K-445	1200
60	G.E. NEW	K-504	1200
60	G.E. NEW	K-504U	1200
60	Al. Ch.	AR-826F	514
50	Al. Ch.	AR-445	1800
50	G.E.	KF-4052	3600
50	G.E.	KT-327	1800
50	Westg.	CS-648	1800
50	G.E. TEFC	K-444	1200
50	G.E.	KT-343	1200
50	Burke	EM-7	900
50	G.E.	KT-348	900
50	G.E.	IK-13	900
40	*Al. Ch.	ARX-405	3600
40	G.E.	KF-4048	3600
40	Westg.	CS-640	1800
40	G.E.	KT-332	1200
40	Al. Ch.	AR-504	900
40	G.E.	KT-338	900
40	G.E.	KT-342	720
30	Howell	HBB-328	3600
30	Westg.	CS-405	1800
30	G.E.	K-444	1200
30	Al. Ch.	AR-204	900
25	Cr. Wh.	118Q	1200
25	Westg.	CS-556A	1200
25	G.E.	KT-332	900
25	Al. Ch	AR-220C	900
20	Westg.	CS-354	1800
20	G.E.	KT-3018	1800
20	Louis Allis	XL-835	1200
20	G.E.	KT-312	1200
20	Westg.	CS-464-C	1200
20	Westg.	CS-944	900
20	G.E.	KT-328	900
15	Westg.	CS-326	1800
15	G.E.	KT-312	1200
15	G.E.	FRT-961	1200
15	Westg.	CS	900
15	G.E.	KT-322	900
15	G.E.	KT-332	720
10	G.E.	KT-181	3600
10	G.E.	KT-181	1800
10	Howell	SC-350	1800
10	Cr. Wh.	SC-60	1800
10	G.E.	KT-752	1200

SLIP RING MOTORS

3 phase, 60 cycle—220 or 440 volt (*2200 volt or higher)

H.P.	Make	Type	Speed
2500	*G.E.	MT	257
2000	*G.E.	MT-30	240
1250	*G.E.	M	720
1200	*G.E.	MT-26	277
800	*Westg.	CW	587
650	West.	HE	360
500	Westg.	CW	360
500	Westg.	IE	1800
400	G.E.	CW	450
300	*G.E.	IE15A-4	1800
300	G.E.	IM-17	1200
250	Westg.	CW-32B	900
250	Westg.	CW	600
200	G.E.	IM	600
150	Al. Ch.	ANV	900
100	G.E. NEW	M6332Z	900
100	G.E. NEW	M6334	720
100	Westg.	CW-856C	900
100	G.E.	IM-15A	450
75	G.E.	IM-E-4	1800
75	Westg.	CI-758A	600
75	Cr. Wh.	240	600
75	G.E.	IM-14	514
60	*Westg.	CW-782C	900
50	G.E.	IM-11A	1800
60	G.E.	MT-346-B	900
50	Westg.	CW-636A	1200
50	*Al. Ch.	ARY-220BS	1800
50	G.E.	IM-14	425
50	G.E.	MT-343	1200
50	G.E. NEW	M-505	1200
40	Westg.	CW-644C	900
37	G.E. TENV	HITC-5012	600
35	G.E.	IM-E	1200
35	Fr. Nrse.	UAB-JM12D	1800
30	G.E. NEW	M504-U	900
25	Westg.	CI-572A	900
30	G.E.	MT-332	1200
25	G.E.	IM-11	1200
25	Al.Ch.	ARY-220C	900
20	Al.Ch.	ARY-218D	1200
20	Westg.	CI	900
20	G.E.	IM-12	600
20	Westg.	CW-644C	600
20	G.E.	MT-332	900
20	G.E.	MT-503-4	1800
15	G.E.	MTC-955S	1200
15	G.E.	IM	1200
15	G.E.	IM	900
15	Westg.	CW	900
15	Al.Ch.	ARY218D	900
15	G.E.	ITC-501D	720
10	Al.Ch.	ANY	1200
10	Westg.	MW-308	1200
10	Al.Ch.	ARY-210C	900
7½	G.E.	MT	1200
6½	Rob.Mey.	425A	1200

2 COMPLETE VARI-VOLT DRIVES

M.G. Set, 200 K.W., D.C. gen., Elec type MPC, 250 volts, 800 amps, 1200 RM, dir conn. to 300 HP syn. motor, Gen. Elec. type TS. 3 ph. 60 cy. 440 volt, .8 PF, 1200 RPM

D.C. Motor, 250 H.P., Gen. Elec. type MPC, 245 volt, 730/975 RPM, with complete starting and control panels.

MOTOR GENERATOR SETS

K.W.	Make	A.C.	D.C.
1000	G.E.	4000	275
500	G.E.	2300	230
500	G.E.	440	250
500	G.E.	4000	1200
450	G.E.	2300	250
200	Cr.Wh.	2300	125
200	G.E.	440	250
150	Al.Ch.	220	125
100	G.E.	440	250
75	Star	440	230
75	G.E.	440	250
60	Al.Ch.	2300	110
60	Fr.Morse	220	125
50	Westg.	220	110
40	Cr. Wh.	220	125
25	G.E.	440	250
20	G.E.	440	250
20	G.E.	440	125
15	Ideal	220	125
10	Cr. Wh.	220	125
10	Ideal	220	125

LOW VOLTAGE—M.G. SETS

Amp.	Make	A.C.	D.C.
1500	Chandyn	440	60
1560	G.E.	2300	80
1000	Chandyn	440	40
333	Columbus	440	45

BALANCING SETS

4—34 K.W., 250 V., 270 A. nou. Beguo, type MCI, 125 V. gen. BB comp'd d/a on fab base

2—20 K.W. 250 V., 160 A. nou. Cr. Wh. type 151, 125 V gen 3 sl. brg. Close coupled.

SYN. A.C. MOTORS

3 phase, 60 cycle—220 or 440 volt (*2300 volt or higher)

H.P.	Make	Type	P.F.	Speed
1000	*Westg.	SC-3D350	.8	900
700	*G.E.	ATI	.8	720
450	El.Mach.		.8	720
320	*Al.Ch.	Dr. Prf	1.0	240
250	*Al.Ch.		1.0	720
200	*Al.Ch.		1.0	360
150	G.E.	ATI	.8	600
125	G.E.	TS-954B	1.0	1200
100	Cr.Wh.	103-S	.8	900
100	G.E.	ATB	.8	900

A.C. GENERATORS

3 phase, 60 cycle—220 or 440 volt (*2300 volt or higher)

H.P.	Make	Type	P.F.	Speed
1000	*Westg.	503D	.8	900
725	*G.E.	ATI	.8	720
250	*Al.Ch.		.8	720
156	G.E.	ATI	.8	600

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two 100 KW 250 Volt DC Generators. Steam driven by Ball Engines—140# pressure.

one 200 KW 250 Volt DC Generator. Steam driven by Ball Engine—140# pressure. Units complete with DC switchboard and two balancer sets.

one 20 ton York Vertical Ammonia Compressor. Steam driven by Corliss Engine—140# pressure.

one 15 ton York Vertical Ammonia Compressor. V belt drive. 33 H.P.— DC motor. Complete with condenser, receiver, valves, gauges, etc.

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SPECIALS

600# 150000#/hr. } B. W.
600#115000#/hr. } Unused
400# 50000#/hr. } Boilers

Pulv. or G & O. B.W.

1500 KVA Leffel-Allis Hydro. Tur. Gen.
5000 G.P.M. F.M. Vertical Pump 30' Head
4000 Gal. per day Unused G.R. Evaporator
600 KW Nordberg Uniflow Plant—2 Units.

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5—300 H.P. Combustion Engineering Co.
1—250 H.P. Stirling, Class-H.
3—72" suspended H.R.T. single set

H. P. BREARLEY

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2— 150 KVA. 60 CY. 1 PH. 2400-240/480 SCOTT TAPS.
6— 100 KVA. 60 CY. 1 PH. 2400-240/120.
6 75 KVA. 60 CY. 1 PH. 2400-240/120.
9— 50 KVA. 60 CY. 1 PH. 2400-240/120.
7—37½ KVA. 60 CY. 1 PH. 2400-240/120.
8— 15 KVA. 60 CY. 1 PH. 2400-480/240.

ALSO ALL TYPES OF AIR COOLED AND PHASE CHANGERS.

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NEW & REBUILT POWER EQUIPMENT-IN STOCK

DIESEL GENERATOR SETS

2—300 KW, G.M. 8-268A, 1200 RPM, 230 V. DC (NEW). We can supply new AC Generators for these, any voltage.
2—300 KW, G. M. 8-268A, 1200 RPM, 3/60/450 V. (Rebuilt).
6—100 KW, Worthington, BB5, 600 RPM, 3/60/230 or 460 V. Never commercially used—run for test purposes only.
1—60 KW, G.M. 671-RC, 1200 RPM, 3/60/110/220/440 V. complete with radiator. Only used 100 hours.
1—40 KW, Buda 6-DTG 468, 1500 RPM, 125 V. DC.
1—30 KW, Buda 6-DTG 317, 1450 RPM, 125 V. DC.

GENERATORS

4—300 KW, West., 1200 RPM, 120/240 V.
1—75 KW, G. E., 1800 RPM, 3/60/220/440 V.
1—100 KVA, G. E., 900 RPM, 360/2300 V.

GEAR REDUCERS & VARI DRIVES

QU.	Mfg.	Type	Ratio	HP
3	Link Belt	PIV-V1	2-1	3
1	Link Belt	PIV-V4	2-1	10
1	Link Belt	PIV-H3	4-1	7½
2	Reeves	000	2-1	2
2	Reeves	0	2-1	5
1	Reeves	2	2-1	10
1	Reeves	5D	4-1	10
1	Reeves	5221D18	5-1	1½
2	Cleveland	400AH	5-1	50
4	Philadelphia	00AT	5-1	2
1	Cleveland	200AH	6-1	25
1	James (vert.)	450VB	6-1	5
1	James	81	6-1	3
8	Saco	8	10-1	15
9	Saco	6	10-1	7½
3	Link Belt	DL5	16-1	15
7	Link Belt	D4	19-1	7½
2	Boston	TB25	24-1	2
1	Philadelphia	1075UTS	24-1	20
1	Foote	590P	28-1	60
1	Foote	8HGS	34-1	10
3	Link Belt	HWB50	35-1	5
2	Boston	40UG	40-1	2
1	Falk	7DB	43-1	25
1	Cleveland	100AH	50-1	3
1	Philadelphia	369R2	68-1	10
1	Palmer	160B	108-1	7½
2	Link Belt	HWB60	110-1	3
2	James	306DW	233-1	5
5	Foote	10HGVD	2064-1	2

PUMPS — ECONOMY — NEW

9—VSL, vert., Sump, 50-125 GPM, 19-54 ft.
2—CS, Boiler Feed, Turbo Drive, 100 GPM, 462 ft.
1—MF3, Boiler Feed, Turbo Drive, 200 GPM, 58 ft.

HOISTS & CRANES—Lidgerwood, 3 drum, 20,000 lbs. @ 180 FPM, with 150 HP, 700 RPM, West. C.I. Motor 3/60/440.
5-ton Wright, O.T.C., 21'4" span, 125 FPM, lift 25 ft., 3 motors, 3 phase, floor operated.
24-ton Wright, Chain Hoist.
10-ton Reading, Chain Hoists (2).
2-ton Wright, Chain Hoists (4).

ARC WELDERS—330 & 400 amps. G.E. & Hobart. All current models. R&G.
BOILER—Dowtherm, 500,000 BTU, 125#.
CARPULLER—L.B. 5000#, 5 HP.
AIR CONDITIONING—5 ton Carrier.
AIR RECEIVER—5'x14', ASME, 263# WP.
AIR COMPRESSOR—I.R. 6500 CFM, 10# (UNUSED).
GAS PURIFIR—Complete. 2000-16000 CFH.
STEET STACKS—42"x37' (3).

X. P. MOTORS—(NEW) CLASS I, GROUP D SQ. CAGE—3 PH.

Quan.	HP	Make	Speed
6	100	West.	1800
3	75	West.	1800
5	50	West.	1200
6	50	G. E. & West.	1800
5	30	West.	1800
5	25	A.C. & West.	1200
5	25	West.	1800
10	20	G. E. & West.	1200
6	20	West.	1800
11	15	G. E. & West.	1800
12	10	G. E. & West.	1200
10	10	West.	1800
11	7½	West. & L. A.	1200
10	7½	West.	1800
11	5	West. & A. C.	1200
10	5	West.	1800
12	3	West.—G.E.—F.M.	1200
10	3	West.	1800
10	2	West.	1200
10	2	West.	1800
11	1	West. & C. W.	1200
11	1	West. & A. C.	1800

TEFC MOTORS — (NEW) SQUIRREL CAGE — 3 PHASE

Quan.	HP	Make	Speed
1	100	Howell	900
3	100	West.	1800
4	100	West.	1200
6	75	West. & G. E.	1800
3	75	West.	1200
2	50	West.	1800
3	50	West. & A.C.	1200
5	30	West. & G. E.	1800
2	30	West.	1200
10	25	West. & C. W.	1800
11	25	G. E. & West.	1200
10	20	West.	1800
8	20	West.	1200
12	15	West. & A. C.	1800
9	15	West. & L. A.	1200
10	10	West.	1800
10	10	West.	1200
12	7½	West. & G. E.	1800
11	7½	West. & Rel.	1200
10	5	West. & G. E.	1800
14	5	West.-G. E.—Rel.	1200
2	3	West. & C. W.	3600
12	3	Diehl & West.	1800
10	3	West.	1800
12	3	G. E. & West.	1200
3	2	U. S. & G. E.	3600
10	2	West. & G. E.	1800
14	2	West.-Rel.-C.W.	1200
3	1½	Diehl-Elec. Dyn.	1800
2	1½	G. E.	1200
10	1	West.	1800
13	1	West. & G. E.	1200
4	½	G. E.	1200

GEARHEAD MOTORS

Quan.	HP	Make	Speed	Type
1 (New)	15	West.	350	D.P.
1 (New)	15	West.	125	D.P.
1	10	U. S.	56	XP. Vert.
1 (New)	10	West.	230	D.P.
1 (New)	7½	West.	350	D.P.
1 (New)	7½	West.	190	D.P.
2 (New)	5	West.	350	D.P.
1 (New)	5	West.	125	D.P.
1 (New)	5	West.	68	D.P.
2 (New)	3	West.	125	D.P.
1	3	Master	337	T.E.
2	2	G. E.	57	X.P.
1	1	Sterling	45	D.P.
1	½	Sterling	290	D.P.
1 (New)	½	G. E.	86	D.P.
1 (New	1/3	West.	72	D.P.
1	¼	Master	215	D.P.
1 (New)	¼	West.	96	D.P.

MOTORS — (Rebuilt) SQUIRREL CAGE — 3 PHASE

Quan.	HP	Make	Speed	Type
1	150	West.	700	C. I.
1	150	West.	1200	Slip-ring
3	125	Wagner	1800	TEFC
2	50	Howell	1200	TEFC
4	50	Lincoln	1200	Open
1	35	G. E.	900	KT-Open
1	30	G. E.	900	KT-Open
4	25	Lincoln	1200	Open
1	25	West.	900	Open
1	20	F. M.	1800	D.P.-QZK
2	20	G. E. & Linc.	1200	Open
1	20	G. E.	1800	KF-TEFC
2	15	F. M.	1800	QSZC-TEFC
3	15	West.	1800	TEFC
1	15	G. E.	1800	KF-TEFC
2	15	West. & Linc.	1200	Open
1	10	A. C.	3600	TEFC
5	10	Lincoln	1200	Open
3	7½	West.	1800	TEFC
1	7½	G. E.	1800	KF-TEFC
3	7½	Cr. Wh.	1800	D. P.
5	5	Lincoln	1800	Open
1	5	F. M.	1800	D. P.-QZK
1	3	West.	3600	TEFC
3	3	Howell	1800	KH-TEFC
5	3	West.	1800	TEFC
3	3	G. E.	1800	D.P.-K
1	2	Lincoln	1800	Open
2	2	A. C.	1200	Open
1	1	G. E.	1800	D.P.-K
5	½	G. E.	1800	D.P.-K

VERT. MOTORS — (REBUILT) SQUIRREL CAGE — 3 PHASE

Quan.	HP	Make	Speed	Type
3	40	G. E.	1200	D. P.
1	40	G. E.	1200	Slip-ring
1	30	G. E.	1200	D. P.
1	25	G. E.	720	Slip-ring
3	25	G. E.	1200	D. P.
1	25	U. S.	1800	D. P.
4	20	L. A.	1200	Slip-ring
1	20	G. E.	1200	D. P.
1	20	G. E.	1800	TEFC
1	20	G. E.	1800	D. P.
1	15	Cr. Wh.	490	BB-D. P.
2 (New)	15	L. A.	1800	TEFC
1	15	West.	1800	D. P.
1	10	L. A.	720	TEFC
3	10	G. E.	1200	D. P.
3	7½	G.E.	1800	TEFC
1	7½	G. E.	1800	D. P.
1	7½	L. A.	3600	TEFC
3	5	L. A.	1200	TEFC
1	5	L. A.	1200	D. P.
6	5	G. E.	3600	X. P.
29	3	Elec. Dyn.	1800	D. P.
18	3	Elec Dyn.	1800	TEFC
3	3	G. E.	1200	D. P.
3	2	West.	900	D. P.
1	2	West.	1200	D. P.
5	2	G. E.	1800	D. P.
4	1½	G. E.	1800	D. P.
12	1	Master	1800	D. P.

VALVES — NEW

10—Powell, 14" Motorized, Gate, 300#.
2—R P &C., 12", Gate, OS&Y, 125#.
19—R P &C., 6", Gate, IBBM, 125#.
6—R P &C., 4", Gate, IBBM, 125#.
3—Walworth, 12", Lub. Plug, 150#.
3—Walworth, 8", Lub. Plug, 300#.
6—Walworth, 3", Lub. Plug, 150#.

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FROM AVAILABLE STOCK

Rebuilt to N.I.S.A. Standards

MOTOR GENERATOR SETS

3 ph. 60 cycle

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
1	1400	Whse.	352	700	2200
1	1800	G.E.	600	125/250	4000
1	1500	G.E.	600	600	2300/4150
1	1500	G.E.	360	275	2200/4400
1	1250	G.E.	600	275	2300
1	1000	G.E.	720	250	2300/13200
1	1000	Whse.	900	600	2300/4150
1	1000	West.	514	250	4150
1	800	G.E.(3U)	1200	120/240	2300
1	750	Whse.	900	250	2300
1	500	G.E.	900	250	440/2300
1	500	G.E.	720	125	2300/4000
2	400	G.E.	720	250	440/2300
1	400	G.E.	1200	130/240	440
1	400	G.E.	720	600	2300
1	350	G.E.	900	135	2300/4150
1	300	Whse.	1200	250	1200
1	150	Cr. Wh.	1200	250	440
1	140(3U)	Cr. Wh.	900	125/250	2200
1	100	G.E.	1170	125	220
1	75	Cr. Wh.	1170	250	220/440

ROTARY CONVERTERS

60 Cycle

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
1	2000	G.E.	514	600	13800
1	2000	G.E.	450	600	2300
1	1000	Whse.	900	600	11000
1	750	Whse.	900	600	13200

RECTIFIERS

1	750	G.E.	BHW	575	2300
1	1000	A.C.	GRZ	625	13500
1	1000*	A.B.B.	GRZ	625	6600/12200

*This unit with full automatic control good for both 25 and 60 cycle.

TURBO GENERATORS

Qu.	KW	Make	Desc.
1	1000	G.E.	Condensing 135/150# ISP 2300/4150 V 3 ph. 60 cy.
2	750	G.E.	Condensing 250/375# ISP 440V, 3 ph. 60 cy. (New 1944)
1	500	Al. Ch.	Non-condensing 125/150# ISP, 5/20# B.P. 480V. 3 ph. 60 cy. with exciter.
1	450	Worth	Condensing 250# ISP geared to 1200 RPM. 440V. 3 ph., 60 cy. gen. with exciter.
2	400	G.E.	Condensing. 275# ISP. Geared to 1200 RPM. 120/240V. D.C. Generator.
1	300	G.E.	Non-condensing 150/175# ISP 5/15# B.P. 480V. 3 ph. 60 cy.
1	200	Al. Ch.	Condensing 425# ISP Geared to 1200 RPM 120/240V. D. C.
2	200	Cr. Wh.	Condensing 250# ISP GEARED to 1200 RPM—125V. D.C. Gen.
1	200	Whse.	Non-condensing 150# ISP 7# B.P. 240V. 3 ph. 60 cy.

TRANSFORMERS

60 Cycles

Qu.	KVA.	Make	Type	Ph.	Voltages
1	2500	Packard	AT	3	13800 x 2300
1	2500	Al. Ch.	OISC	3	13200 x 2300
3	1000	Pitts.	OISC	1	13200 x 2300
3	1250	G.E.	H	1	6600 x 500
1	1050	G.E.	WCTH	3	11000 x 445
5	667	Al. Ch.	OISC	1	13200 x 230/460
1	600	Al. Ch.	OISC	3	4000/2300 x 216
3	333	Maloney	C	1	7620/13200x120/240
3	333	Pitts.	OISC	1	26400 x 2600
6	250	Whse.	OISC	1	11000 x 240
3	200	Whse.	OISC	1	7200 x 240/480

D. C. MOTORS

HP	Make	Type	Volts	Speed
1—2100	Whse.	REV	700	50/125
1—1750	Whse.		600	525/720
1—1500	Whse.		525	600
1—1200	Whse.		600	425
1—940	Whse.	QM-R Brg.	250	140/170
1—800/1000	Whse.		450	600/720
1—650	G.E.	MPC	250	115/145
1—600	Al. Ch.	MILL	230	400/800
1—300/400	G.E.	DYNA	250	1325/2500
1—335	Whse.	MQ	250	300/900
1—200/300	G.E.	MPC	250	360/920
1—275	Whse.	QM-600-6	230	425/850
1—250	G.E.	MPC	230	400/560
1—150	G.E.		600	250/750
10—150	Cr. Wh.	83H	230	800

FREQUENCY CHANGERS

1—500	A.C.	25/60 Cycle	11000/2300V	

A. C. MOTORS

3 ph. 60 cycle

SYNCHRONOUS

HP	Make	Type	Volts	Speed
2—3500	G.E.	TS	2300	257
1—2100	G.E.	ATI	4600	514
2—2000	Whse.		2300	120
1—1170	Whse.		4600	900
1—1000	Whse.		2300	1895⅞
2— 900	Al. Ch.	(New)	2200	150
1— 650	Whse.	G	2200	138
1— 600	Whse.	Syn.	440	360
1— 450	Whse.	Eng.	2200	128.5
2— 350	G.E.	TS	2200	150
1— 320	G.E.	ATI	2300	600
1— 300	G.E.	ATI	440	720
1— 300	Whse.		2300	720
1— 300	Al. Ch.		440	600
1— 225	G.E.	ATI 1-Brg.	440	900
1— 125	G.E.	ATI	440	450
1— 100	E.M.	Unused	440	600
1— 100	Whse.		550	600

SLIP RING

2— 700	Whse.	CW	2300	900
1— 500	G.E.	IP	550	505
1— 500	G.E.	1M-MIII	2200	450
1— 350	Whse.	CW	2200	900
1— 350	G.E.	MT-442Y	2200/4000	253
1— 300	Al. Ch.	3 Brg.	2300	595
1— 300	G.E.	1M	440	720
9— 300	Al. Ch.	ANY	2200	705
1— 250	G.E.	M-567-TEFC	440	600
1— 250	G.E.	MT-424Y	4000	257
1— 250	G.E.	MT-559S	2200	1750
6— 125	G.E.	MT-566Y	440/2200	435
4— 100	G.E.	MT-566Y	440/2200	425
2— 100	G.E.	1M-16	2200	435
2— 100	G.E.	1M	440	600
2— 100	Al. Ch.	AK	2200	1200

SQUIRREL CAGE

2— 450	Whse.	CS	2300/4150	354
1— 200	G.E.	IK	550	865
1— 200	G.E.	KT-557	440	1800
1— 200/112	G.E.	KF-559BS	440	1170/885
1— 125	Whse.	MS	440	685
1— 125	(New) G.E.	KF-TEFC	440	1190
1— 125	G.E.	KF-TEFC	440	8585
3— 125	Al. Ch.	ARW	2200	1750
1— 100	Al. Ch.	AR	2200	1170
1— 100	G.E.	IK-Vert.	2300	450
2— 100	G.E.	KT-543	220/440	1750
3— 75	G.E.	KT-547Y	2200	1160

SYNCHRONOUS CONDENSERS

Qu.	Kva.	Make	Type	Volts	Speed
1	5140	Whse.		4150	600
1	4000	G.E.	TSC	2400/4800	900
1	3000	Whse.		4800	720

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POWER PLANT EQUIPMENT

SPECIAL OFFERINGS

TURBO-GENERATORS

2—New 4000 KW 4160 V. 60#
1—3500 KW 550 V. 200# Cd.
1—2500 KW 550 V. 250# Cd.
2—1000 KW 2300 V. 400# Cd.
2—1000 KW 2300 V. 200# Cd.
2—1000 KW 480 V. 180# Cd.
1— 750 KW 240 V. 150# Cd.
1— 750 KW 550 V. 170# EX.
1— 750 KW 2300 V. Ext.
1— 500 KW 2300 V. Ext.
1— 500 KW 550 V. Cd.
1— 500 KW 125/250 V. Cd.
1— 465 HP Turbine 800#

BOILERS

2—50,000# 300#
1—30,000# 400#
1—680 HP—200#
2—500 HP—400#
1—487 HP—200#
2—250 HP—125#
2—220 HP—160#
1—72" HRT 150#

DEAERATING HEATERS

3—90,000# Pr. Hr.

ENGINE GENERATORS

1—500 KW 2300 V. Unit.
1—375 KW 2300 V. Unit.
1—168 KW 220 V. Unit.

DIESEL GENERATORS

2—800 KW—2300 V.
2—200 KW—480 V.

COMPRESSORS

33,330 CFM—Cent. 7#
4900 CFM—Gas 50#
1700 CFM—100#
500 CFM—Diesel (2)

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225 HP Busch Sulzer Model DF, 3 cyl., 4 cycle, solid injection, 360 RPM. Direct erator with direct connected exciter, air connected 150 KW 3/60/2300 volt genfilter, muffler, etc. A modern unit in perfect condition only $4000 f.o.b. St. Louis.

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Boilers to meet your needs
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all with LOW capital cost.

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SELLING FOR CUSTOMERS

1000 KW, 2300 volt Gen. Elec. REBUILT condensing turbine 175 S.P.
300 KW 240 V Westinghouse geared Nonsond. turbine
400 KW 480 V 1200 RPM Elliott generator with 1200/4500 gear
285 KVA 240 V Chuse inline engine set.
2000 Amp. 3-pole GE Air breaker with Bus Duct.
300 & 200 KW Syn M.G. Set with control.

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FOR SALE
ELECTRIC BATTERY CHARGER

Practically New

Mfgr.—Electric Products Co. MB Set—50 HP, 220/440 V, 3 PH, 60 C, 60 Amp, 750 RPM, Cont. Duty Generator, AC Amp 60, DC Volts 84, DC Amp 120, 30 KW Dist. Board 5 circuits each charging 42 cells Edison type alkali battery, all auto. control, auto. starter.

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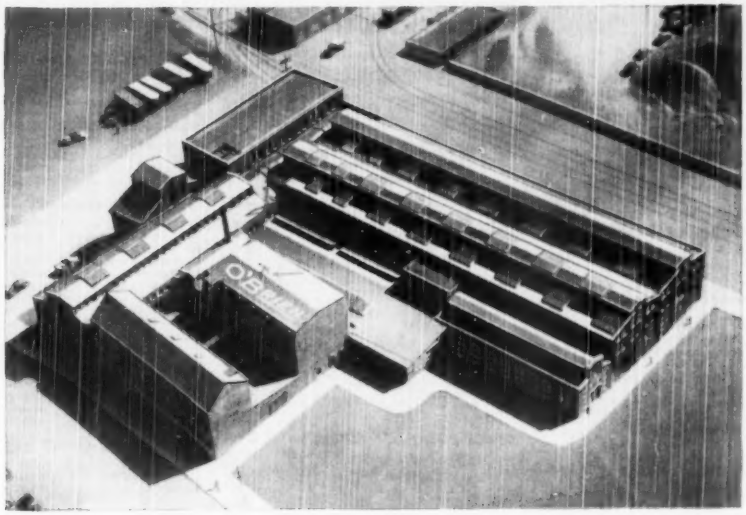

I N T E G R I T Y

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1545 N. DELAWARE AVE., PHILADELPHIA, PA.

ELECTRIC MOTORS

3 PHASE — 60 CYCLE

Q.	HP	Make	Type	Volts	Speed
1	1200	Cr. Wh.	SI. Rg.	2300	257
1	1000	West.	CW	2300	450
2	600	West.	Syn.	440	257
1	600	G.E.	IM	440/2300	600
1	450	G.E.	TS(Syn)	440	360
1	350	West.	CW	440	600
1	350	G.E.	Syn.	440	900
1	315	G.E.	Syn.	2200	720
1	250	West.	CS	2200 (25 cyc)	375
1	250	West.	CS	2300	1200
1	250	G.E. New	TEFC	550	600
1	200	West.	MW	440	600
2	200	West.	CW	440	600
2	180	G.E.	Syn.	4000	257
1	150	Al. Ch.	SC	220	1800
1	150	Ideal	Syn.	220	1200
1	150	El. Mch.	Syn.	220	900
1	150	G.E.	KT-558	440	900
1	125	G.E. New	TEFC	550	900
1	125	G.E. New	TEFC	550	1200
1	125	Cent.	SC	440	1800
2	100	West.	CS	220	1800
1	100	Cr. Wh.	Syn.	220	1800
1	100	Cent.	SC	220	1200
1	100	G.E.	IM	440	600
2	75	Cent.	SC	440	1200
1	75	West.	CW	440	1200
1	60	Ideal	SC	220	1200
1	60	West.	CW	440	600
1	50	West.	CS	550	1800
2	50	Cent.	SC	220	1200
1	100	West.	SK183	230V. D.C.	400/1200
1	50	Cr. Wh.	CMC	230V. D.C.	800/1200

MOTOR GENERATOR SETS

1—1000KW GE MPC ATI 550v. 3/60/2300
1— 500KW GE MPC ATI 250v. 3/60/2300/720 rpm
2—400KW ELLIOTT COMPANY, 250 volt, 1200 rpm, 2300 volt, 60 cycle A.C. and D.C. Controls—New 1939
1—200KW G.E. 250 volt, 3/60/2300, 1200 rpm Synchronous
1—100KW G.E. 125 volt, 3/60/220/1200 rpm Synchronous
1— 50KW G.E. 250 volt, 3/60/240/1200 rpm
1— 50KW G.E. 125 volt, 3/60/220/1200 rpm
1— 40KW Ideal, 125 volt, 3/60/220/1200 rpm

AIR COMPRESSORS

1—3000CFM Sullivan Angle Compound 100 psi, 500 HP Syn. M.D. 3/60/2300
1—1050CFM Worthington, 18x11x14 100 psi, 257 RPM, Belted
1—1950CFM Ingersoll-Rand ES-1, 17¾x13, 50 psi, 275 RPM, V-belt
1—884CFM Chicago Type YCM, 125 Lb., 125 HP Syn. M.D. 3/60/440 Automatic Control
1—734CFM Sullivan Angle Class W13, Single Stage 13x13x8, 60 Lb., 300 RPM, v-belt, 100 HP
2—528 CFM Chicago NSB, 100 Lb., 285 RPM, V-belt, 14x12
2—368CFM Ingersoll ER-1, 285 RPM, 100 psi., 50 HP direct gear, M.D., 3/60/220
1—294 CFM Ingersoll ES-1, 10x11 Direct Syn., M.D., 3/60/440, 100 psi., automatic control
1—220CFM NEW Chicago PR 4 Air Cooled, 870 RPM, 125 Lb., V-belted, 50 HP, M.D.
1—245CFM IR-10x10 ER-1, 125 Lb.
1—215CFM Penna. 3A—10x8, 50 Lb.
1—211CFM NEW Chicago 9x9 T-B Horizontal 100 psi, V-belt
2—173CFM Ingersoll ER-1, 9x8, 300 RPM, 100 Lb., V-belt
3—120 CFM I-R—8x6 ER-1, 55 Lb.
1—92CFM I-R —7x6, ER-1, 100 Lb.
1—67CFM Chicago NSB—6x6—150 Lb.

DIESEL GENERATORS

200KW Fairbanks Morse, 250 v., D.C. 720 rpm 8 cylinder, 4 cycle, Complete—1940
200KW G.E.-Fairbanks Morse, 720 rpm, 3/60/220/440—8 cyl, 4 cycle—1940
156KVA Cummins LI 400 3/60/440/900 rpm—Radiator—Sw. Bd.
112KVA Waukesha Portable, 3/60/440, 1200 rpm—1944
100KVA Cooper Bessemer 8 cylinder, 900 rpm, 3/60/220
56KVA G.E.-Climax Gasoline Portable, 3/60/220/1200 rpm
40KVA NEW Chrysler 3/60/220—2 units
30KW Buda, 3/60/220/1200 rpm
20KW Le Roi Gasoline—1/60/110-220 volt

TURBO-GENERATORS

Non-Condensing

1—625KW West. 3/60/2300/3600 RPM, 125 Lb. psi, 6 Lb. B.P.
1—400KW West. 3/60/480, 150 psi., 10 Lb. B.P.
1—300KW Elliott (New 1941) 250 Volt D.C., 150 Lb. I.S.P., 20 Lb. B.P.
1—300KW G.E. 3/60/2300/100 p.s.i. 0-15 Lb. B.P.
1—300KW G.E. 3/60/2300/3600 RPM, 175 psi, 5 Lb. B.P.
1—160KW West. 3/60/220/3600 RPM, 125 Lb. psi, 10 Lb. B.P.
1—160KW Ridgeway 4 Valve Steam Engine Generator, 3/60/220
1—150KW NEW West. 250 Volt D.C. 225 Psi., 25 B.P.
1—100KW NEW 3/60/220 150/200 psi. 0/30 Lb. B.P.
1—50KW West. 3/60/220/1800 RPM, 150 psi. 10 Lb. B.P.
1—35KW G.E. 125 volt D.C., 3600 RPM

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TURBINE UNITS

1—5000 KVA G. E. Non-C. 60 cy. 13200 V. 600-lb.
1—3125 KVA Worthington Non-C. 60 cy. 2300 V. 150-200 lb. 40 lb. BP
1—2500 KVA G. E. Extr. Cond. 60 cy. 480 V. 185-200-lb. steel valve chest.
1—1563 KVA G. E. Extr. Cond. 60 cy. 480 V. 200-lb.
1—1250 KVA Allis Cond. 60 cy. 2300 V. 150-200 lb.
2—1250 KVA Elliott Cond. 60 cy. 480 V. 150-200 lb. 600° Surface Condenser
1—1250 KVA DeLaval Non-C. 60 cy. 2300 V. 250-lb.
1— 25 KW Allis Non-C. DC 125 V. Exciter Dual drive turbine & motor.

DIESEL ENGINE UNITS

2—1400 HP Fair. Morse 2400 V. 60 cy.
3— 700 HP Gen. Motors 2300 V. 60 cy.
3— 650 HP Amer. Loco. 440 V. 60 cy.
1— 600 HP Fair. Morse 2400 V. 60 cy.
1— 400 HP DeLaVergne 2400 V. 60 cy.

STEAM ENGINE UNITS

1—1125 KVA Hamilton Uniflow 2300 V.
1— 312 KVA Skinner Uniflow, 480 V.
1— 312 KVA Ames Uniflow 240 V.
1— 250 KVA Ames Vertical Uniflow 480 V.
1— 250 KVA Ames Vertical Uniflow 240/480 V.
2— 187 KVA Ames Vertical Uniflow 240/480 V.

ROTARIES — 60 CY.

QU.	KW	MFR.	VOLTS D.C.	TRANSF.	RPM
1	3250	G.E.	225/285	13800	300
1	2000	A.C.	600	4150	514
2	1000	West.	600	4150	720
1	1000	G.E.	600	13200	900 Auto.
3	750	West.	600	11000	1200 Auto.
2	500	West.	250	13200	1200

SPECIALS

3—700 HP General Motors Diesel 8 cyl. 4 cy. 360 RPM dir. con. to 485 KW .8 PF 3/60/2300 V. generators.

2—1250 KVA Elliott 3/60/480 V. 3600 RPM generators dir. con. to 150-200 lb. IP 600° TT turbines with dir. con. exciters, surface condensers and pumps.

MOTOR GENERATOR SETS — 60 CY.

QU.	KW	MFR.	VOLTS D.C.	A.C.	RPM
2	1500	G.E.	600	4150	600
1	500	West.	125	2300	720
2	300	G.E.	250	2300	1200
1	300	West.	250	440	1200
1	200	G.E.	250/275	2300	1200
1	75	Star	240	440	1200
1	75	West.	125	440	1200

SYNCHRONOUS CONDENSERS

QU.	KVA	MFR.	VOLTAGE	RPM
1	2500	G.E.	2400/4160	720
1	2000	West.	2300	720
2	1500	G.E.	2400/4160	900
1	1500	G.E.	4600	900
1	1000	West.	2300	900

SYNCHRONOUS MOTORS — 60 CY.

QU.	HP	MFR.	VOLTAGE	RPM
1	4350	Cr. Wh.	13800	514
1	500	Ideal	4160/2400	1200
1	600	G.E.	440	360
2	350	G.E.	2300	257
1	300	G.E.	2300	600
1	300	West.	2300	900

MERCURY ARC RECTIFIERS

2—4500 KW Multi Anode 600 V. DC
2—3250 KW Ignitron 650 V. DC
1—1000 KW Ignitron 600 V. DC

FREQUENCY CHANGERS

2—2500 KVA G.E. 25/62½ cy. 750 RPM
2—1250 KVA West. 25/60 cy. 300 RPM
2—1000 KVA G.E. 25/60 cy. 300 RPM
1— 500 KVA Al. Ch. 25/60 cy. 300 RPM

TRANSFORMERS — 60 CY.

1— 7500 KVA G.E. 138000—41000, 3 ph.
1— 7000 KVA Al. Ch. 66000—2400, 3 ph.
3— 1000 KVA West. 66000—7200
2— 100 KVA West. 44000—7200/12470Y
3— 75 KVA G.E. 44000—2300/4600
1— 5000 KVA West. 34500—13750, 3 ph.
2—15000 KVA Al. Ch. 33000—12500 Y, 3 ph.
1— 5000 KVA G.E. 33000—2300/4000, 3 ph.
3— 667 KVA G.E. 33000—2300/4600
6— 75 KVA Mel. 33000/16500—2300/6900
3— 3750 KVA West. 26400/13200—2400
4— 450 KVA Al. Ch. 25410/44000—13280/23000
3— 333 KVA G.E. 13200—2400/4160 Y
3— 750 KVA West. 13200—440
3— 167 KVA G.E. 7200/12400—240/480
1— 1500 KVA West. 4800—2300, 3 ph. Auto.
3— 250 KVA Al. Ch. 2300—460

OIL CIRCUIT BREAKERS

1— 600 A. 73 KV G.E. FHKO-139 Outdoor
1—1200 A. 34.5 KV G.E. FKO-339-1000 Outdoor
4—2000 A. 15 KV G.E. FKO-339-1000 Outdoor
4— 600 A. 15 KV G.E. FHKO-138-BS Outdoor
2— 600 A. 15 KV West. B-28-B-500 Indoor

BREW, WOLTMAN & CO., INC.

50 Church Street — New York City 7, — WOrth 4-1470

Quality SINCE 1906

Wente SINCE 1906 *Motors*

WIDE SELECTION UNUSUAL VALUES

THEIR ELECTRICAL CONSTRUCTION HAS BEEN REBUILT... BY EXPERTS

SQUIRREL CAGE
3 ph.—60 cy.—220 or 440 V.
(Other voltage as noted)

Qu.	HP	Make	Type	Speed
1	80	G.E.	I (2200 V.)	900
3	60	Al. Ch.		900
1	60	G.E.	KT	1800
4	60	G.E.	KT (2200 V.)	1200
1	60	Reliance	AA	900
1	60	West.	CS (TEFCBB)	1200
1	75	West.	CS (TEFCBB)	1200
1	60	West.	CS Gearhead	232
1	100	G.E.	KT (2200 V.)	900
4	100	G.E.	K (TEFCBB)	1200
1	110	G.E.	KTP	1800
1	120	G.E.	PT	3600
8	125	Al. Wh.	AR	450
2	150	Al. Ch.		1750
1	250	G.E.	KF (Vert.)	3600

SLIP RING—SYNCHRONOUS
3 ph.—60 cy.—220 or 440 V.
(Other voltage as noted)

1	50	Al. Ch.		720
1	50	Ideal	AV	600
1	50	G.E.	I	700
1	60	Ideal	AVX	1200
3	70 KW	G.E.	T-4 (.7PF)	1200
1	75	West.	CW	400
1	75	G.E.	I	520
1	75	Fr. Morse	BV (2200 V.)	1800
1	100	G.E.	TRR (1.0 PF)	600
1	100	G.E.	I-16 (2200 V.)	450
1	100	KW G.E.	ATB (.8 PF)	900
1	120	KW G.E.	TS (.7PF)	1200
1	125	Fr. Morse	T (2400 V) (PF1.0)	900
1	150	West.	CW	450
1	300	West.	CW (3 Bear.)	600

D.C.—230 VOLT
(Other voltage as noted)

1	50	West.	SK	850
1	50	G.E.	CD 1341	500/2000
3	50	Reliance	T	2700
1	50	West.	SK (115 V.)	500
1	60	West.	SK (115 V.)	500/1500
1	75	Diehl	K11	700
2	75/100	Reliance	T1050	300/900
1	100	West.	SK	850
1	100	Cr. Wh.	CM	600
1	130	Cr. Wh.	CMC (550 V.)	1200
1	150	West.	SK	400/1200
1	150	West.	SK	850
1	180	Cr. Wh.	CMC	450
2	200	Reliance	T2550	300/900
2	200	G.E.	TLC-74	1350/4000
1	225	West.	SK	1050

M-G SETS

1— 45 KW West. 60 V DC—440 V AC 1200 RPM
4— 60 KW G.E. 60 V DC—440 V AC 1200 RPM
2— 75 KW Ft. Prod. 220 V DC—440 V AC 1200
1—100 KW West. 250 V DC—440 V AC 1200
1—100 KW West. 250 V DC—440 V AC 900
1—100 KW Reliance 250 V DC—220 V AC 1200
1—100 KW Ridge 275 V DC—440 V AC 1200
1—150 KW G.E. 275 V DC—440 V AC 900
ALSO—4000 motors other than listed from 1 HP to 200 HP

The Wente Electric Co., Hamilton 203 NO. FOURTH ST. Phone 4-8128 Ohio

---

600 KW DIRECT CURRENT GENERAL MOTORS DIESEL SET

Westinghouse Generator 500 Volt, 720 RPM, Electric Start. Unused.

450 HP ENTERPRISE DIESEL ENGINE
Model DSG-6, 6 cyl., 4 cycle, 450 RPM, air start, solid injection unused.

Other sizes in stock from 10 to 1000 KW.

ALJOHN DIESEL CO., INC.
904-10 Pacific St., Brooklyn 16, N. Y.
STerling 3-6515

5000 KVA., 3 PHASE TRANSFORMER

IMMEDIATE DELIVERY

1—5000 KVA., Gen. Electric Type HT, Form DH, 3 Phase, 60 Cycle, 33000 Volts Primary with 4—2½% taps below—2300/4600 Delta and 4000Y Vs. secy.

ARCHER & BALDWIN, INC.
(Inc. 1917)
75 West Street New York 6, N. Y.
Tel: BOwling Green 9-9275 & 9276

FOR SALE

3 used I-R; 12x12x12 duplex double acting Imperial type 10; 250 RPM 50 lb. belt driven air compressors belt wheel 5 ft. diameter.

1 Used D.C. Motor 65 HP 110 v. compound wound, 500 RPM, newly reconditioned.

FS-7139, POWER
330 W. 42nd St., New York 18, N. Y.

For Sale Cheap

GENERATORS

SPRAGUE ELECTRIC CO. Generator, Serial #212180, Type S 300 K.W., 1200 Amp. 230 250 Volts D.C. DIRECT CONNECTED TO CHUSE ENGINE. Serial #1166, Size 23"x28", Speed 150 RPM.

ALLIS CHALMERS, Serial #118157, 125-250 Volts 600 Amp. Direct Current. DIRECT CONNECTED TO FIRE BALL ENGINE. Serial #6420, Size 17"x20", Speed 200 R.P.M.

ALLIS CHALMERS GENERATOR. Serial #106331, 50 K.W. 80% power Factor. 230 Volts 3 phase 60 cycle ALTERNATING CURRENT DIRECT CONNECTED TO AMES ENGINE. Serial #38565, Size 10"x12", 300 R.P.M.

25 H.P. A.C. Motor driven Direct Current Generator

DIRECT CURRENT MOTORS

230 Volt D.C.

1—40	h.p. 1750 rpm	3—	1½ h.p. 1750 rpm
1—20	h.p. 1250 rpm	3—	1½ h.p. 900 rpm
1—	7½ h.p. 1150 rpm	4—	1 h.p. 1150 rpm
2—	6 h.p. 1150 rpm double shaft	1—	1 h.p. 750 rpm
3—	5 h.p. 1750 rpm	2—	¾ h.p. 1725 rpm
3—	5 h.p. 900 rpm	8—	¾ h.p. 1150 rpm
3—	4 h.p. 1550 rpm	11—	½ h.p. 1725 rpm
3—	4 h.p. 900 rpm		double shaft
5—	3 h.p. 1560 rpm vertical	3—	½ h.p. 1150 rpm
2—	3 h.p. 900 rpm	4—	1/3 h.p. 1750 rpm
5—	3 h.p. 400-1600 rpm variable speed and controls	2—	1/3 h.p. 1150 rpm
		10—	¼ h.p. 1750 rpm
		1—	1/12 h.p. 1750 rpm

(Make offer one or all)

LONG-HALL LAUNDRY CO.
Woodland & 17th on Seventeenth
KANSAS CITY, MO.

BOILER

1—250 H.P. Kewanee—fire box type. The last of five other purchasers well pleased.

DIESEL — ELECTRIC

300 H.P. Fairbanks, Model 32E14, 250 K.V.A. alternator 3-60-4160-2400. Said to have been operated only four hours for test.

AIR CONDITIONING EQUIPMENT

2—75 H.P. direct connected Chrysler Airtemp Radial Compressors.

2—25 H.P. direct connected Chrysler Airtemp Radial Compressors.

2—100 ton Marlo Condensers, fans, pumps and controls.

All above located Evansville Ordnance Plant, Evansville, Indiana.

If interested contact

W. J. SIMPSON
c/o Owensboro Milling Company
Owensboro, Kentucky

VERTICAL HYDRO-ELECTRIC UNITS

1 new 1200 KW 3 phase 60 cycle 2400 volt with Leffel turbine, governor and panel board for 26' head.

1 250 KW like new with Smith turbine and Lombard governor 3 phase 60 cycle 2400 volt for 20-22' head.

1 144 KW GE 3 phase 60 cycle 240 volts 120 RPM with Smith turbine 8-12 head.

Many horizontal units up to 750 KVA and heads of water up to 150'.

We are headquarters for good used hydro-electric units. For full particulars write

WM. C. MOULTON ASSOCIATES
Monson, Massachusetts

FOR SALE

Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

PENN MACHINERY COMPANY
Jackson, Miss.

WAGNER CERTIFIED REBUILT

ELECTRIC MOTORS & GENERATORS

Backed by 44 Years of Quality & Service

M-G SETS

KW	Mfr	Input V	Output V
500	G.E.*	2300/4000 AC	600 DC
300	Allis Ch.*	220/440 AC	250 DC
300	Gen. Elec.	440/38 cy.	275 DC
300	Whse.*	2300/4000 AC	600 DC
200	G.E. b.b.	220/440 AC	250 DC
200	Ridgeway*	2300/4000 AC	550 DC
200	Gen. Elec.*	220/440 AC	125 DC
200	Reliance*	220/440 AC	250 DC
150	Burke*	220/440 AC	250 AC
105	Century b.b.	220/440 AC	70 DC
100	Allis Ch.	220/440 AC	125/250 DC
100	Allis Ch.	2200 AC	250 DC
75	Gen. Elec. (3)	220/440 AC	125 DC
75	Cr. Wh. b.b. (2)	220/440 AC	250 DC
75	Star* b.b. NEW	220/440 AC	250 DC
50	Whse.	220/440 AC	250 DC
50	Gen. Elec. (2)	220/440 AC	125 DC
65	Whse.	220/440 AC	250 DC
60	Gen. Elec.	220/440 AC	30 DC
40	N.W. conv.	220 AC	230 DC

*Syn. motor drive.

D. C. MOTORS

HP	Mfr	Type	Volts	Speed
200	Reliance	1970T	230	575/750
150	Cr. Wheeler b.b.	TEFC	230	800
100	Whse.	SK181	230	450/900
100	Gen. Elec.	C	230	575/1000
100	Gen. Elec.	RC36	115	1150
75	Allis Ch.	E-140	230	500
75	Northw'n	KB	230	1750
75	Cr. Wh. NEW b.b.	CMC-HH	230	1150
75	Century NEW	DN	230	850
75	Whse.	SK181	230	300/1200
60	Century NEW	DN	230	1150
60	Century NEW	DN	230	1750
50	Cr. Wheeler	FH	230	1750
50	Cr. Wh. b.b.	101H	230	300/1200
40/60	Whse. (2)	SK160	230	500/1000
40	Cr. Wheeler	EH	230	1750
40	Century NEW	DN	230	1150
40	Whse. (2)	SK130	230	950
35/50	Gen. Elec.	CD123	230	575/1150
30	Whse.	SKB3	230	1750
75	Whse.	SK160	230	850
60	Cr. Wh.	50H	230	700
25	Whse.	SK150	230	300/1200

- EXPLOSION PROOF MOTORS—
- GEARHEAD MOTORS, AC & DC.
- FREQUENCY CHANGERS.
- CIRCUIT BREAKERS, AC & DC.

D. C. GENERATORS

HP	Mfr	Type	Volts	Speed
300	Gen. Elec. 1 brg.	DMC	275	720
200	Reliance	1970T	250	720
150	Cr. Wheeler b.b	TEFC	250	1200
105	Century b.b.	1500 amp.	70	1200
100	Gen. Elec.	C	250	750
100	Allis Ch. 3 wire	MCW	120/240	1200
100	Gen. Elec.	DLC	125/250	675
75	Cr. Wh. NEW b.b.	HH	250	1450
75	Allis Ch.	E	250	750
75	Gen. Elec. (2)	RC36	125	1200
65	Whse.	SK160	250	1100
25	G.E. b.b.	CDM	25	1200
50	Cr. Wheeler	50H	250	900
40	Whse.	SK	250	1200

A. C. MOTORS—25 CYCLE

HP	Mfr	Type	Volts	Speed
200	Gen. Elec.	I-M	440	750
150	Whse.	HF	440	500
150	Gen. Elec.	IK-16	440	750
100	Gen. Elec.	I-K	440	500
50	Gen. Elec. Int.	MTC5337	440	750
50	Gen. Elec.	I-K	440	750
50	Gen. Elec.	KT338	440	1500
40	Gen. Elec.	KT343	440	750

A. C. GENERATORS—60 CYCLE

KVA	Mfr	Type	Volts	Speed
625	Gen. Elec.	ATB	2300	450
300	Gen. Elec.	ATB	600	720
250	Whse.	G	2400/480	720
225	Gen. Elec.	ATB	240/480	600
187	Gen. Elec. (3)	ATB	240/480	900
156	Elec. Machy.	3 brg.	240/480	514
125	Gen. Elec.	ATB	240/480	720
125	Gen. Elec.	ATB	240/480	300
625	G.E. 25 cycle	ATB	2300	750
275	G.E. 25 cycle	ATB	440	750
100	El. Machy.	B.B.	2400	900

A. C. MOTORS—SLIP RING

3 Phase 60 Cycle 220 or 440 Volts

Qu	HP	Mfr	Type	Speed
1—	600	Gen. Elec.	I-M	360
1—	500	G.E. 3 brg.	I-M	450
1—	400	Gen. Elec. 2300V.	IM-EB	1800
2—	300	Allis Ch. 2200V.	ANY	720
1—	300	Gen. Elec. 2200V.	I-M	1800
1—	300	G.E. b.b. New	M568	900
1—	250	Allis Ch. 2200V.	ANY	514
1—	200	GE. 2200V.	I-M-17A	450
2—	200	Gen. Elec. 2200V.	I-M-16	600
1—	200	Gen. Elec.	I-M	360
2—	150	Gen. Elec. 2200V.	I-M-16	600
1—	150	G.E. 2200/4000V.	I-M	1200
1—	150	Allis Ch.	ANY	600
1—	150	Gen. Elec.	I-M-17	450
1—	125	Gen. Elec.	IM-15	720
1—	100	Gen. Elec.	I-M	720
1—	75	Howell	8R443	1800
1—	75	Gen. Elec.	I-M-IS15	1200
2—	75	Gen. Elec.	I-M-14	720
1—	75	Gen. Elec. Int. duty	MTC5342	900
1—	75	Gen. Elec.	MT558	600
1—	75	G.E. 2200V.	MT556	720
1—	60	Allis Ch.	ANY	900
1—	50	Howell	8R437	1200
1—	50	Gen. Elec. Int.	ITC5613	600
1—	50	Gen. Elec.	I-M	720
1—	40	Gen. Elec. Int.	WTC5526	900
1—	400	Gen. Elec.	I-M	514
1—	100	Gen. Elec.	I-M	900
1—	100	G.E. Vertical	MT553	1200
1—	100	Gen. Elec.	IM-15A	514
1—	50	Gen. Elec.	MT326	1200
2—	40	Whse.	CW6030A	1200
1—	40	Gen. Elec.	MT546	900

A. C. MOTORS—SYNCHRONOUS

HP	Mfr	Type	Volts	Speed
600	Gen. Elec. (2)	TS	2200	514
300	Whse.	G	2200/440	600
300	Gen. Elec.	ATI	440	720
220	G. E. 3 brg. SPF	ATI	220/440	900
200	GE. SPF	ATI	220/440	900
190	El. Machy.	3 brg	220/440	514
150	Gen. Elec.	ATI	220/440	300
150	Gen. Elec. (2)	ATI	220/440	720
100	American b.b.	TGH	220/440	900
75	Whse.	SPF late	220/440	1200
225	Burke	AC28	220/440	1200
125	El. Machy. (2)	B.B.	2400/4800	900
125	El. Machy.	B.B.	440	900
125	Whse. (2)	late	2200	1800

A. C. MOTORS—SQUIRREL CAGE

3 Phase 60 Cycle 220 or 440 Volts

Qu	HP	Mfr	Type	Speed
1—	400	Whse. 2200V.	CB	1800
1—	325	Gen. Elec.	KT420	400
1—	250	Gen. Elec.	PTS40AZ	3600
1—	250	Gen. Elec.	PT349	3600
1—	250	Whse.	C8004A	720
1—	200	Whse. b.b. NEW	C8875	1800
1—	150	Gen. Elec. TEFC b.b.	K43288	1200
1—	150	Gen. Elec.	I-K-16	600
1—	150	Reliance b.b. NEW	B6085	1200
2—	150	Gen. Elec.	KP537	1200
1—	150	Gen. Elec. 2200V.	IK-161A	1800
1—	125	Gen Elec.	K50558	1800
1—	125	Reliance b.b. NEW	C8065	1200
1—	125	Allis Ch. 2200V.	AN	1200
1—	125	Gen. Elec.	I-K-16	450
1—	125	Cont. 2200V. b.b.	SC	1800
2—	125	Rel. TEFC NEW	B6085	1800
1—	125	F.M. 2200V. vertical	UH-16D	1200
3—	100	Allis Ch. 2200V.	AR336	1200
1—	100	Reliance b.b. NEW	C5085	900
1—	100	Rel. TEFC NEW	C8085	1200
1—	100	Gen. Elec. b.b. NEW	K5048	1800
1—	75	Allis Ch. b.b.	ARW445	3600
1—	75	Lima b.b.	R8505	1200
2—	75	Gen. Elec.	I-K	600
1—	75	Reliance b.b. NEW	C8084	900
1—	75	Reliance TEFC NEW	C8084	1200
1—	75	Reliance b.b. NEW	C5085	1800
1—	75	Gen. Elec.	KT339T	3600
2—	75	Reliance b.b. NEW	C505	1200
1—	60	Gen. Elec.	KT343	720
2—	60	Reliance b.b. NEW	B504	1800
2—	60	Reliance TEFC NEW	C8065	1200
2—	60	Reliance b.b. NEW	C504	1200
2—	60	Whse. H.T.	C8504	1800
1—	60	Wagner b.b.	RP444	3600
1—	50	Allis Ch. b.b.	ARK445	1800
1—	50	G.E. NEW b.b. HT	KG405	1800
2—	50	Reliance b.b. NEW	C448	1200
1—	50	Whse. hiallp	WL407	900
2—	50	Gen. Elec.	KT252	600
1—	50	Allis Ch. 2200V.	AR445	1800
1—	250	Gen. Elec.	I-K	1200
1—	60	G.E. 2200V.	KT343	1200
1—	50	Gen. Elec.	KT346	720

QUICK SHIPMENT FROM STOCK — LOW PRICES — FULL GUARANTEE

Arthur Wagner Co.
1435 W. RANDOLPH ST. MO nroe 6-7405 CHICAGO 7, ILLINOIS

SLIP RING MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Speed
600	2200	G.E.	1800
500	2300	G.E.	450
450	440/220	Whse.	514
350	2300/440	Whse.	600
300	440/220	Whse.	900
300	2300/440	G.E.	1200
200	440	G.E.	450
150	440/220	Whse.	600
150	440/220	Whse. (2)	1800
150	2300/440	G.E.	1200
150	440/220	G.E.	720
100	440/220	G.E.	600
100 (2)	440/220	Whse.	900
100	2300/550	G.E.	1800
60	440/220	G.E. (MTC)	900
75	2300/550	G.E.	1800

SYNCHRONOUS MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Type	RPM
400	440/220	G.E.	ATI	600
300	2300/440	G.E.	TS	720
300	440/220	G.E.	ATI	600
250	440/220	Whse.	HR	277
250	440/220	G.E.	ATI	600
250	4000/2300	El. Mchy.	Syn.	600
240	2300/440	G.E.	ATI	720
200	440/220	G.E.	TS	720
200	4150/2300	Whse.	G	1200
120	440/220	G.E.	ATI	900
110	440/220	G.E.	TS	257
100	440/220	Whse.	G	1800
75	2300/440	Whse.	GE	600

GENERATOR SETS

1—625 kva. 1200 rpm, 220 volt. Whse., geared to 7300 rpm. Whse., non-cond. steam turbine, 150 lbs. gr.
3—unused 25 kva, 120/280 v., 3 ph., 1200 rpm, generator dir. conn. to Waukesha 6 cyl. gas engine

TURBO-GENERATOR

Generator, 62½ kva, 1200 rpm, 440/220 V., Whse., geared to 50 kw, 7300 rpm, non-condensing.

CIRCUIT BREAKERS

2—2000 amp., GG E, 3 pole, 600 v., air
2—1000 amp., ITE, 3 pole, 600 v., air
2—1200 ampere, Whse., 3 pole, 600 v., air

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
650	440	G.E.	FT	3600
500	2300	Cr. Wh.	SC	1800
500	440/230	G.E.	IK	900
350	2300	G.E.	KT	1200
300	2300	G.E.	FT	3600
300	2300	G.E.	KT	1800
250	2300/440	L. Allis	OGS	1200
200	440	G.E.	IK	514
200	440/220	Whse.	CS	1200
200	440/220	G.E.	KT	1800
200	2300/440	G.E.	KF	720
200	2300/550	Cr. Wh.	SC	900
200	2300/440	G.E.	KT	1200
200	440/220	G.E.	IK	450
150	440/220	G.E.	IK	450
150	2300/550	Whse.	CS	900
150	440/220	G.E.	KT	720
150	440/220	Howell	B. Brg.	1800
150 vert.	440/220	G.E.	KTP	1200
150	440/220	G.E.	IK	514
150	440/220	Whse.	CS (NEW)	900
100	2300/440	G.E.	K	1200

A. C. GENERATORS

1—320 kva, 660 rpm, 2300/440/220 V., G.E.
1—250 kva, 720 rpm, 2300/440 v., G.E.
1—225 kva, 600 rpm, 220/440 v., G.E.
1—225 kva, 720 rpm, 2300/440 v., G.E.
1—150 kva, 900 rpm, 480/240 v., G.E.
3— 75 kva, 1800 rpm, 480/240 v., Whse.

D. C. MOTORS

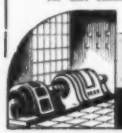
HP	Volts	Make	Type	Speed
350	230 (2)	G.E.	CD	1150
250	230 (3 new)	Cr. Wh.	CMC	1800
200	230	Cr. Wh.	CMC	850
150	230 (new)	Cr. Wh.	CMC	900
100	230	Cr. Wh.	CMC	625
100	230	G.E.	CD	1750
75	230	G.E.	CD	1150
75	230	Whse.	SK	850

MOTOR GENERATOR SETS

1—300 kw, 1200 rpm, 250 v., G.E., connected to 500 hp, 1200 rpm, 2300/440 v., synchronous
1—165 kw, 1200 rpm, 240 v., G.E., conn. to 250 hp. 1200 rpm, 440/220 v., squirrel cage
1—100 kw, 250 v., Hertner, 1200 rpm, connected to 150 hp, 2300/440 v., synchronous
1—80 kw, 1200 rpm, 250 V., G.E., connected to 135 hp 2200/440 V. squirrel cage motor
1—75 kw, 125 v., 1200 rpm, G.E. conn. to 120 hp, 2200/440 v. syn. motor.
1—50 kw, 250/125 V., 1200 rpm, 3-wire, G.E., conn. to 75 hp, 440/220 V., sq. cage

TRANSFORMERS 60 Cy.

3—667 kva, Whse., 33,000—2300 V.
3—333 kva, G.E., 13,200—2300 V.
3—333 kva. Whse., 2400—480/240 V. Dry
3—250 kva, G.E., 6900/13,800—230/460 V.
3—250 kva, Whse., 11,000/22,000—2300 V.
3—250 kva., Whse., 2300—208 V.
3—200 kva, Whse., 13,200—2300 V. (Insteen)
6—150 kva, Al. Chal. 2400—240/120 v.
1—150 kva, Whse. 8K, 13200-125/215 v., 3 ph
3—100 kva, G.E., 4600/2300—230/460 V.
3—100 kva, G.E., 13800—230/115 v., NEW
6—100 kva, G.E., 4600-2300-230/115 v., NEW
3—100 kva, G.E., 450-115/230 v., dry, 1 ph, new
2—75 kva, G.E., 480—240/120 v. Pyranol
3—50 kva, G.E., 480—240/120 V., Pyr



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2— 1,000 KW same as above
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Complete Steam Plants with 2—1250 KW; 2—2500 KW; 2—3000 KW & 7500 KW
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Steam generator unit powered by Chuse steam engine equipped with Baker Piston valve direct connected generator 120 K.W. 2300 volt 225 RPM exciter mounted direct on engine shaft. See it perform.

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Detroit Overfeed Rotostoker—double feed. Capacity: 500 boiler H.P. Grate area: 45 sq. ft. Grate dimensions: 6 ft. x 7 ft. 6 in. Stokers complete with forced draft fans. Stoker parts: 4 feed units, 2 drive units, 2 blower fans, 2 wind tunnels, 2 set grates, 2 boiler fronts for mounting feed units.

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2—Crocker Wheeler (NEW) 600 KW, 2300/460/3/60/720.
2—Westinghouse (NEW) 500 KW, 2400/480/3/60/720.

Each direct connected to General Motors Diesel Engine and complete with new, modern Switchboard.

SEE THESE UNITS OPERATE UNDER FULL LOAD IN OUR PLANT.

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VARIABLE VOLTAGE DRIVES

40 HP Reliance Variable Voltage Drives, each Consisting of:
1—40 KW 230 Volt, Induction M-G Set, with two auxiliary 5 KW generators and exciter.
1—40 HP 400/1500 RPM, Frame 385T, 230 Volt, DC Motor.
With full magnetic control providing leg forward, leg reverse, run, fast, slow, and stop, and motor operated field rheostat.

SLIP RING MOTORS—3 Ph., 60 Cy.

Qn.	H.P.	Speed	Volts	Make	Type
6	7½	810	550	G.E.	MTC-5201
2	10	1140	440	West.	HF-7A
2	10	870	220	G.E.	HI-11
2	11‡	820	550	G.E.	ITC-5008
2	15	1160	440	West.	CW-464C
2	15	870	220	West.	CW-646
1	15	580	440	West.	MW-316
1	20	860	440	West.	CW-638
1	25	1130	550	G.E.	MT-323
2	25	850	220	Wagner	BR
2	25	720	440	Wagner	22VBR
1	30	885	440	West.	CW-646
1	30	350	440	G.E.	MT-352
1	30	675	440	G.E.	MT-336
2	35	600	440	F-M	HV-H16A
2	40	865	2200	Al.Ch.	ARY-223C
1	40	580	440	G.E.	MT-348
2	50	1150	440	G.E.	M-536
1	50	880	440	West.	HF-12A
1	50	870	440	G.E.	MT-552
5	52‡	850	220	G.E.	IQC-5013 ***
1	60	885	440	West.	CW-758
1	60	570	550	G.E.	MTC-5546
1	60	345‡	550	West.	CW-958
1	80‡	575	440	G.E.	MTC-5352
3	125	430	440	G.E.	IL-16
2	150	1750	440	G.E.	MTP-549
1	175	865	550	West.	CW-1062
2	200	600	550*	G.E.	IM-17
1	200	495	2200	G.E.	IM-17A
2	250	600	2300†	G.E.	IM-17
3	300	900	550	G.E.	IM-17
2	300	880	2200	G.E.	IM-17A
4	350	1775	2300	G.E.	IM-E15A
2	350	880	2200	G.E.	IM-17A
1	400	505	550	West.	CW
1	500	1770	440	G.E.	IM-E15C
1	650**	887	440	G.E.	MT-442Y
1	700	735	4000‡‡	West.	CW

220 volt motors can be reconnected for 440 volts.
‡ Intermittent rating. *** 2 phase.
** New ‡‡ 25 cycle.
†Also 440 or 550 volts
*Also 440 or 2300 volts

A.C. GENERATORS — NEW

3 Phase, 60 Cycle, 0.8 P.F., Two Bearing, with Damper Winding and Direct Connected Exciter.

Quan.	KVA	RPM	Make	Volts
4	18.7	1800	Columbia	240/120
5	18.7	1800	Columbia	208/120

230 VOLT CONST. SPEED D. C. MOTORS

Qn.	H.P.	Speed	Make	Type
10	3	850	Reliance	Y-23T
25	3½	850	West.	SK-30
1	7½	1150	G.E.	CDM-65
3	7½	850	G.E.	CD-78
10	10**	1750	Kimble	BA-324
5	10**	1150	Al.Ch.	TFB-80
2	10	850	West.	SK-83
2	13½**	600	West.	SK-93
3	15	1750	G.E.	CD-78
5	15	825	West.	SK-90
1	20	1750	L.A.	ONA-LB51
1	20	1750/1310	West.	SK-83
2	20	1150	G.E.	RC-30
11	20	750	West.	SK-110L
17	25	825	West.	SK-120
1	30	1100	G.E.	RC-12
1	40	1700	West.	SK-103
1	40	750	G.E.	RC-34
1	50	750	West.	SK-150
1	50	850	G.E.	RC-16
1	60	1750/1310	West.	SK-143
1	150	700	Al.Ch.	
2	200	1150	G.E.	RC-38
1	250	1150	G.W.	CMC-101A

230 VOLT ADJ. SPEED D. C. MOTORS

Qn.	H.P.	Speed	Make	Type
6	5/7½	600/1800	G.E.	RA-30
1	10	400/1600	Reliance	T-92T
2	10/15	600/2400	Reliance	T-92T
2	12½	250/840	West.	SK-130
10	12½**	600	West.	SK-93
1	15	600/1200	West.	SK-100L
1	20	500/1500	G.E.	RF-11
1	20/25	300/1200	West.	SK-153
1	25	400/1600	G.E.	RF-13
1	25	500/1500	G.E.	RF-12
1	25/29	300/1200	G.E.	RF-13
1	30	400/1200	West.	SK-143
1	30/40**	400/1600	G.E.	CD-123B
1	35	500/1500	West.	SK-143
1	40/50	400/1200	Reliance	T-9511
1	75	500/1500	Cr.Wh	CCM
1	75	375/750	Cr.Wh	CMC-125H
3	100	225/900	G.E.	MPC-A
8	100	400/1200	Al.Ch.	
1	100	220/900	West.	SK-300
1	125	450/1000	West.	SK-190
1	175	450/1000	West.	SK-230
2	375	250/500	G.E.	MPC

**New.

SQUIRREL CAGE MOTORS—3 Ph., 60 Cy.
Totally Enclosed Fan Cooled, Ball Bearing

Qn.	HP	RPM	Volts	Make	Type
1	5	3480	220	G.E.	K-225
2	5	1750	440	L.A.	JA-254
10	5	1730	440	G.E.	K-254
5	7.5	1740	440	G.E.	K-284
1	10	3480	440	West.	CS-324
1	10	1140	440	Wagner	CPZ-326
1	10**	880	220	West.	CS-365-HXP
1	15	1745	440	West.	CS-326
1	15	1175	440	L.A.	JA-365
1	20	1760	220	G.E.	K-364
1	25	1760	220	G.E.	K-365
1	25	1200	550	G.E.	K-405
1	25	1170	220	L.A.	JX-405
1	25	705	440	West.	CS-W504
1	40	3565	440	G.E.	KF-4058

Splashproof, Ball Bearing

Qn.	HP	RPM	Volts	Make	Type
23	5	1750	440	L.A.	FS-254
1	5	1735	220	G.E.	K-254
1	5	1160	440	L.A.	FX-284
1	10	3480	440	G.E.	K-284
1	15	1175	440	L.A.	JA-365
4	15	1180	440	L.A.	FX-365
3	40	1175	220	G.E.	K-445
3	50	1760	440	L.A.	FX-445A
5	50	1160	220	G.E.	K-504
1	125	1775	440	L.A.	FX-1078Y
1	150	1775	440	L.A.	FX-1168
3	150	880	440	L.A.	FX-1368
1	150	700	440	G.E.	KF-8135
1	200	885	440	L.A.	FS-1378

Open Type Motors

Qn.	HP	Speed	Volts	Make	Type
1	15	3485	220	Reliance	AA-53247
5	15**	1735	440	Century	8C326
1	15	1200	220	G.E.	KT-502
1	15	900	220	G.E.	KT-512
1	20**	3475	220	West.	CS-326
5	20**	1750	440	Wagner	RPL-364
1	20	1750	220	West.	CS-W364
1	20	1200	220	G.E.	KF-511
2	20	1160	440	West.	CS-464C
2	20	900	220	G.E.	FTR-523
4	20	1800	220	G.E.	KF-512
5	25**	1740	440	Century	8C-364
1	25	1160	440	West.	CS-067C
1	25	900	220	Howell	8CRB-356***
2	25**	875	440	Master	440-486
2	25	575	440	G.E.	KT-542
3	30	3550	550	G.E.	K-3648
1	30	1160	440	West.	CS-644
1	30	870	220	West.	CS-646
1	40**	3548	220	G.E.	KF-4048
2	40	1750	440	West.	CS-583C
2	40	900	2300	G.E.	FTR-536
4	50**	1750	440	Wagner	RPS-405
1	50	850	220	West.	CCL
2	60**	1750	440	Ideal	AH-444
2	60	900	440	G.E.	KT-546
1	75	1160	440	West.	CS-6620
1	75	870	220	West.	CS-766A
2	75	865	2300	G.E.	KT-382
1	100	690	220	West.	C
1	100	580	2200	G.E.	IK-15A
2	100	500	2200	West.	CS-930
2	100	495	2200	Al.Ch.	AR
2	125	435	440	Al.Ch.	AR
2	125	400	2300	G.E.	I-17-FR
1	200	580	5501‡	G.E.	KT-5668
2	300	587	2200	West.	CS-89A
1	400	1165	2200	G.E.	IK-E15B
1	500	1200	440	G.E.	KTP-567
1	700	1800	2300/4000	West.	CS4-39D-12

220 volt motors can be reconnected for 440 volts.
**New. ***2 Phase. ‡‡Reconnectable for 440 volts.

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Cradle Type, with Control and Dial Scale
(Write for Complete Specifications)

Qn.	HP	DC Volts	RPM	Type
1	50/75	250	1650/4000	TLC-20
1	200	250	1200	C

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125 and 250 Volts D. C.
(Write for complete Specifications)

KW	Make	RPM	DC Volts	AC
2	Cont.	1750	125	220/440
7.5**	West.	1455	125	220/230§
10	West.	1750	125	220/440
10	West.	1450	125	220/440†
10	West.	1150	250	220/440
15**	G.E.	1800	125	220/440
15	G.E.	1725	250	220/440
15	West.	1450	125	220/440§
18	West.	1750	125	2200/440
20	West.	1750	250	220/440
25	G.E.	1200	250	220/440
30	G.E.	1800	250	220/440
30	Al.Ch.	1750	125	220/440
50	West.	1750	250	220/440
50	G.E.	720	125	220/440†
75	G.E.*	1200	125	220/440
100	Columbia*	1200	250	2300/440
150	West.*	1200	250	2300/440

Note: 3KW, 5KW & 7.5KW, 250 V Sets Available
**New. *Synch. Motor Drive. §50 Cy. †25 Cy.

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4000 KW. Wghse. 480V; Bleeder
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1800 KW. GE 250/450# Cond.
1250 KW (2) Al. Chal., Cond. 2300 V.
1000 KW. (2) Elliott Condensing-Bleeder 3/60/480 V.
625 KW Wghse., Cond. 2300 V.
500 KW. Wghse. Non-Cond.; 250 V 3 wire, DC.
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500 KW. GE 3/60/2400/4160 V—Murray, Cond.
250 KVA. Al. Chal. 240/480 V. Non-Cond.
250 KVA. GE 3-60-600 V. Non-Cond.
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540 HP. Keeler, Heine type 250#
509 HP. B&W Sterling 450#
400 HP. Erie City Heine type 200#
285 HP. B&W 3 drum, type H 250#
250 HP (2) B&W 3 drum type, Type H 160#

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825 KVA GE-Hamilton corliss
750 KVA Wghse.-Skinner Uniflow
500 KVA GE-Skinner Uniflow
450 KVA GE-Chuse 4 V.
312 KVA GE-Chuse 4 V.
312 KVA (2) GE-Skinner Uniflow
187 KVA Wghse.-Ames Uniflow, *Vertical*
62 KVA GE-Ames Uniflow

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1225 KVA Fairbanks Morse, 7 cyl., 300 RPM
1250 KVA (2) GE-Superior, 8 cyl., 360 RPM
500 KVA Fairbanks Morse
250 KVA (2) GE-Buckeye 8 cyl.
109 KVA GE-Superior 3 cyl.
106 KVA GE-Murphy 6 cyl., *Portable*
100 KVA GE-Buckeye 5 cyl.
90 KVA Fairbanks Model 32
75 KVA (2) General Motors; *Portable*
225 HP. Buckeye 6 cyl. diesel engine only
ALL SIZES UP TO 1250 KVA

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850 CFM (2) 110 lbs., Chicago Pneumatic, *diesel driven*
ALSO ALL SIZES 150 CFM to 1000 CFM.

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From 200 to 2500 GPM; from 200 to 2500' hds.
CORLISS ENGINE — 18x36 Allis Chalmers
TRANSFORMERS—MOTOR GENERATOR SETS

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1—2000 GPM 350', 240 HP Turbine.
1—750 GPM 231', 75 HP motor.
2—675 GPM 428', 125 HP Turbine.
2—600 GPM 360', 72 HP Turbine.
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1—200 GPM 555', 50 HP Turbine.
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3—750 and 1000 GPM Knowles Steam Pumps. Also other sizes in stock.
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17—Air Compressors, various cap.
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4—2000 to 5000 GPM 32'-65' hd. 10" & 12" Kingsford Cent. Pumps.
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850 CFM Duplex Air Compressor 12" x 14", 100 PSI, unloaders, lubricator.
290—Rebuilt Elec. motors 1-200 HP.
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1—Hydr. Triplex Pump 2-st. 3000#.
23—Spencer Turbines 35-4000 CF M.
65—Portable & Stationary Agitators.
29—Asstd. Engine dr. Pumps & MG Sets.

SUPERIOR EQUIPMENT CO.
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SYNCHRONOUS ROTARY CONVERTERS

4— 500 KW syn., 600 V., 60 cy.
3— 750 KW syn., 600 V., 60 cy.
3—1000 KW syn., 600 V., 60 cy.
2— 500 KW syn., 600 V., 25 cy. (Portable)

IGNITRONS

1— 300 KW, 600 V., 60 cy.
1—1000 KW, 600 V., 60 cy.

All above complete with Transformers and Automatic Switching.

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1—44 Ton Diesel Electric

100,000 ft. 500,000 CM. Insulated Feeder.

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FOR SALE

Warren Steam Pumps — Duplex

2—12x3x12 3000#
1—6x4x6, 1—5¼x3½x5
Above pumps are rebuilt and in excellent condition.
1—STURTEVANT TURBINE 40 HP
1—84" HRT BOILERS 152 PSI 317 HP with steel and complete trim.
2—24" Motor Operated BUTTERFLY VALVES.

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(At Fraction of Cost)

One Erie City Boiler 225 H.P., Type 2C. Also two Scotch Marine boilers 3165 sq. ft. heating surface; stocker feeds in unknown condition; induced draft fans; boiler feed pumps; usual trim.

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Attention Jack Burke,
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10 TON GANTRY CRANE 50' SPAN, 3 AC MOTORS CAB CONTROL.

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Nordberg 1250 HP diesel elec. generating units.
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C.P.T. air compressor, 1574', diesel.
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Rotary dryers, 6'x35' (2), 8'x40' indirect.
Gantry crane, coal handling, stationary, 100 ft.
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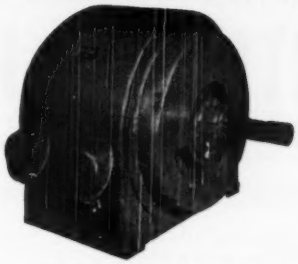

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KW	D.C. Volts	A.C. Volts	Mfg.
500	250	2200	G.E.
400	125/250	2300	Ideal
300	125/250	440/2300	Allis (New)
200	250	2200	Whse.
200	125/250	2200	G.E.
150	250	440	G.E.
125	125/250	2300	G.E.
100	250	220/440	Star (New)
75	250	440	Allis
60	250	220	G.E.
50	250	440	Whse.
30	250	440	Ideal

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SYNCHRONOUS

HP	RPM	Volts	Mfg.	Type
900	150	440	G.E.	80%
650	138	2300	Whse.	Engine
500	514	440	E-M	100%
400	900	2300	Whse.	80%
400	720	440	G.E.	80%
400	600	440	G.E.	100%
350	200	2300	Whse.	100%
300	514	440	G.E.	100%
250	600	4160	E-M	100%
250	514	2300	G.E.	90%
150	900	2300	G.E.	100%
150	1200	440	G.E.	80%
75	900	220	E-M	80%

SLIP RING — R & G.

HP	RPM	Volts	Mfg.
1500	514	2300	Allis
800	514	2300	Whse.
700	450	2300	G.E.
700	720	2300	Whse.
500	450	2300	G.E.
450	514	440	Whse.
400	720	2300	G.E.
350	450	2300	Whse.
300	600	440	G.E.
250	600	440	G.E.
200	1200	440	G.E.
200	720	2300	Elliott
150	1200	2300	G.E.
150	600	440	G.E.
125	900	440	F-M
100	900	2200	A-C
75	75	900	Whse.
50	720	220	Whse.

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Qu.	HP	RPM	Mfg.	Frame
3	3	690/2660	G.E.	284
12	5	850/1700	G.E.	CD-66
5	7½	575/1750	G.E.	CD-77
2	7½	575/2300	Rel.	T-46
1	10	575/2300	L.A.	4051
3	10	1750	Rel.	T-34
2	30	850/1700	Rel.	T-230
1	75	400/1200	Rel.	T-651
5	250	1750	A-C	149

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230 VOLTS D.C.

HP	RPM	Mfg.	Brg.
250	400/1200	E-D	Ball.
200	300/ 900	Whse.	Ped.
200	400/1200	Rel.	Ball.
150	350/1200	Whse.	Ped.
150/200	300/ 900	Rel.	Ball.
125	400/1200	G.E.	Sleeve
125	300/ 900	Rel.	Sleeve
100	500/1500	C-W	Ball.
100	475/1350	E-D	Sleeve
75	500/1500	C-W	Ball.
60	400/1200	Whse.	Sleeve
50	350/1050	Whse.	Ball.
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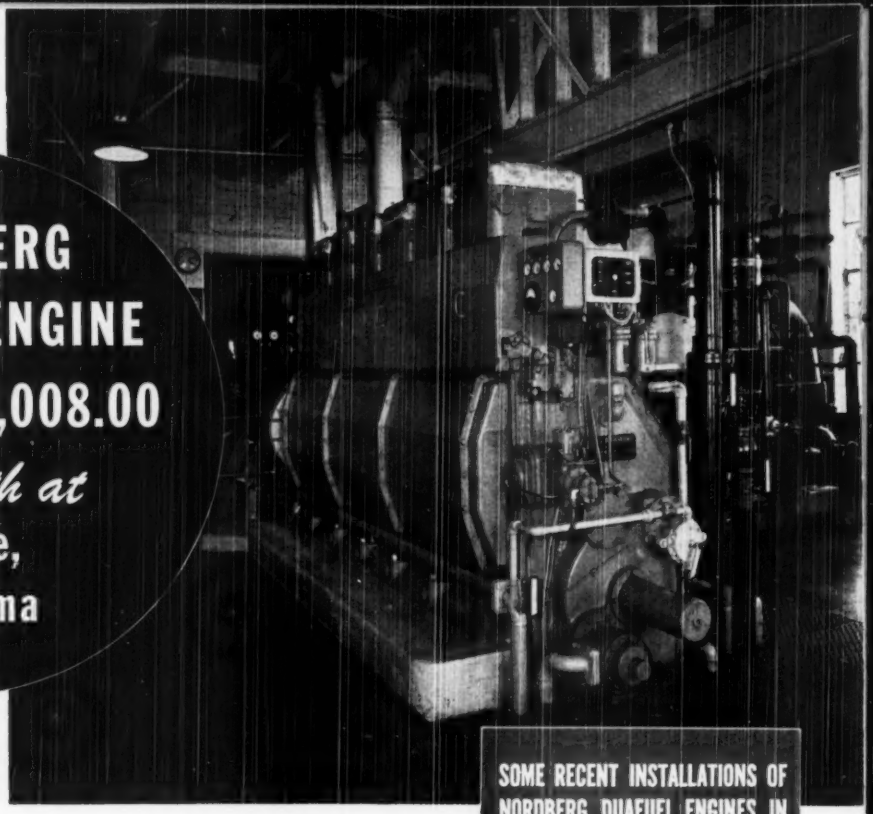

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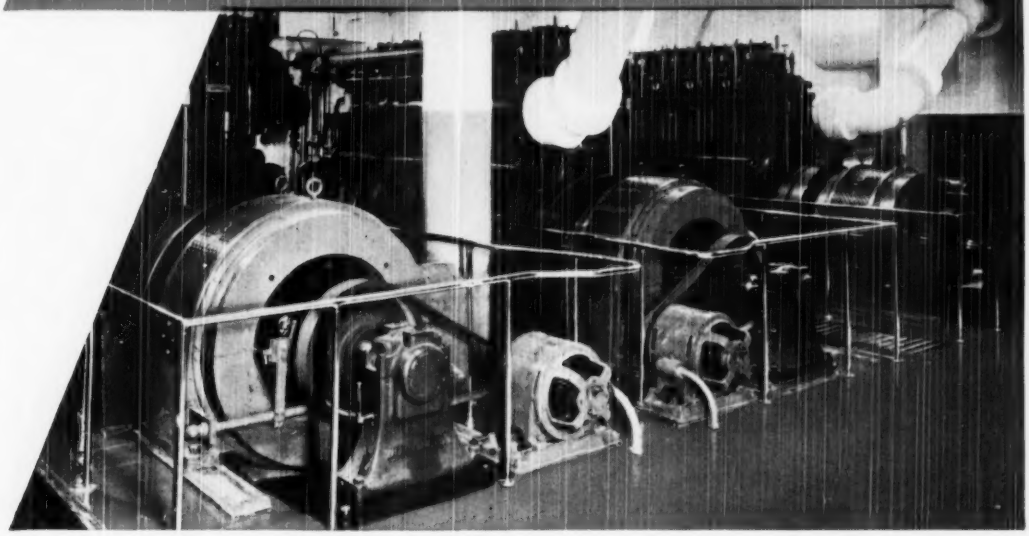

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